THE VICKERS-MAXIM MACHINE GUN

MARTIN PEGLER

WEAPON

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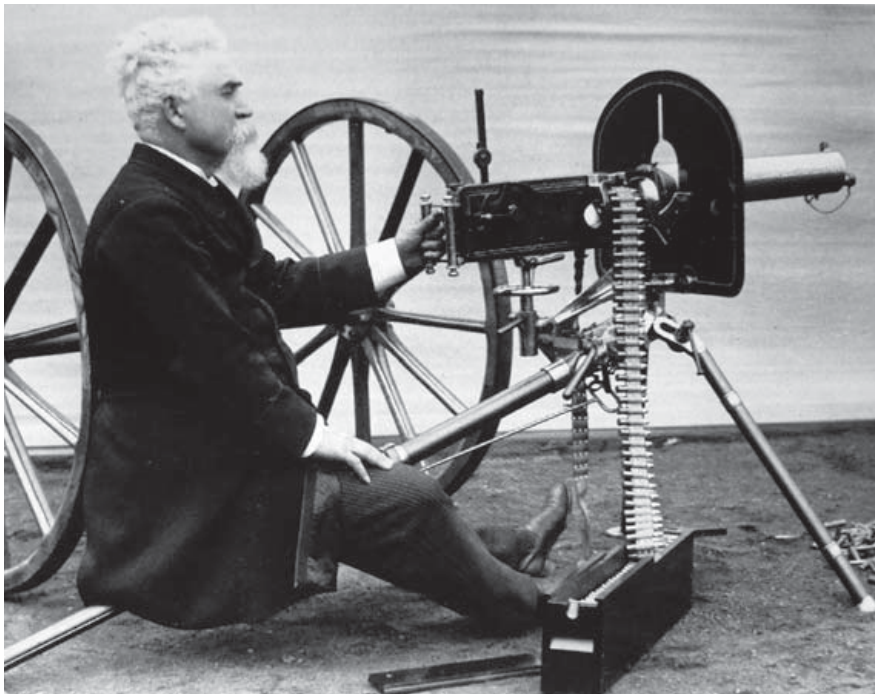

MARTIN PEGLER

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INTRODUCTION

There are certain firearms that have achieved iconic status in modern society through various means: either as a result of press exposure as evinced by the Thompson submachine gun and its much-publicized criminal use in the 1920s, or through extensive use in cinema, where apparently the .45 Colt Single-Action and the Winchester rifle were the only guns ever carried by cowboys; most people today can recognize the Luger pistol as a result of film and TV exposure. Sometimes photographs of military subjects in newspapers and magazines make weapons familiar to the public – almost everyone nowadays recognizes an AK-47, for example. However, there is a secondary category of weapons made up of those that have never really achieved the public recognition that they perhaps deserve. These are the firearms that have done exactly what they were designed to do, without fuss or public acclaim, and in the process have probably been responsible for causing more casualties in warfare than all of the other groups combined.

At the top of this list must surely be the family of machine guns designed by an unknown American possessed of an unusual mechanical genius. Hiram Maxim was to perfect the fully automated machine gun just in time for its use in the greatest conflict yet seen in human history, World War I. This timing proved sadly coincidental, for the appearance of Maxim's gun was the culmination of years of hard work and experimentation to find a method by which a repeating firearm could be made to shoot continuously for as long as ammunition was available. It had long been the dream of firearms designers and manufacturers to create such a device, but they had inevitably been thwarted by technological limitations that always seemed to prevent the next step forwards. Maxim's good fortune was to live at a time when solutions to these mechanical conundrums were at last being found.

The hurdles to be overcome were many, for the earliest attempts in the 18th century to create a repeating gun were hampered by the need for

A Vickers engaging a German aircraft. Even for experienced gunners, this was mostly a waste of ammunition as deflection was almost impossible to estimate accurately using ordinary sights. Note that this gun has the Sangster emergency tripod fitted, to enable the gun to be used if the Mk IV tripod was unavailable. (IWM Q 5172)

powder and ball to be loaded into separate chambers and for each shot to be fired by a less-than-reliable flintlock ignition system. Until the invention in the 1820s of percussion ignition there was no more efficient method of igniting multiple chambers; but percussion finally enabled guns to be kept loaded and primed until they were ready to be fired. It revolutionized long arms and by the mid-19th century had resulted in the production of the modern revolver, by makers such as Adams, Colt and Remington.

In reality, the manufacture of such guns would probably not have been possible were it not for parallel improvements in other vital areas, notably the manufacturing process invented by Sir Henry Bessemer (1813–98) to improve the steels used for cannon production. By blowing oxygen through pig iron he created a high-carbon steel that was stronger and cheaper than anything hitherto produced. If outwardly this invention bears little relationship to the development of the modern machine gun, it must be remembered that all inventions are merely a series of incremental steps, often borrowing from unrelated technologies, each one moving the product up a level in a progress towards eventual perfection. Manufacturers of small arms seized on the process and as a result firearms became stronger, more efficient and cheaper to mass-produce.

Improvements in design and technology continued at an increased pace through the 19th century, each new idea fuelling another. By the early 1860s the simple percussion cap had been adapted to fit inside the base of a hollow brass-foil tube, which was then filled with powder and fitted with a lead bullet. This was the first use of primitive forms of centrefire ammunition and its introduction made possible the development of some of the earliest forms of machine guns. Aside from the mechanical

Zillebeke, in the Ypres Salient, early in 1915. A Mk I Vickers is being cleaned in what appears to be a quiet support trench behind the front lines. At this period, tactical use of the guns was mostly limited to providing immediate cover for the front-line trenches. (IWM Q 51194)

limitations of these early guns (most relied on manual operation, normally by means of a hand crank to operate the mechanism), all of them were hampered by the shortcomings of the available ammunition, to which at the time there seemed to be no ready solution.

The first problem was the impracticability of the brass-foil wrapping of the cartridges, which deformed easily, sprouted verdigris that cemented the brass inside the hot breech and – worst of all – had an unfortunate habit of allowing the extractor to pull off the riveted-on steel base of the cartridge, leaving the remains firmly jammed in the breech of the gun. The secondary problem was that of the propellant, black powder, which suffered from so many shortcomings that it is difficult to know where to begin. Among the more severe were the heavily corrosive residue left behind after firing that would render an uncleaned weapon rusted and useless after a couple of days, the pall of grey-white smoke (300 times the powder's own volume) that hung in the air after shooting, and the

powder's ability to soak up moisture like blotting paper. To keep any form of firearm working required meticulous cleaning, and when used in an automatic weapon black powder quickly gummed up breeches, fouled barrels and caused mechanisms to seize.

The solution to the problem of the brass was to come as a by-product of a totally different technology, for its manufacture as a decorative and practical material had been known before the third millennium BC; indeed, in the 4th century BC Plato wrote of it as being as valuable as gold. It had been possible to manufacture sheet brass for centuries but the technology to form it into complex shapes, other than by hand-beating or casting, did not exist until the late 1800s when experiments into copper/zinc alloys produced a new formula that, allied to the introduction of new high-pressure casting machines, made it feasible to extrude or die-form a thick brass disc into the long tube shape required for cartridge brass.

At the same time a hitherto unknown French chemist, Paul Vielle (1854–1934), had been working on solving the perennial problems of black powder. When in 1884 he perfected a nitro-cellulose-based propellant that was impervious to moisture, produced almost no smoke and created three times the power for the same weight as gunpowder, it seemed like an answer to a prayer. Finally, automatic weapons could be designed that did not require the firer to regularly cease shooting to clean the mechanism; but the problem still remained of how to most efficiently design an automated firearm that took as much of the human element (aside from squeezing a trigger) out of the process as possible.

That it was to fall to Hiram Maxim to do this was as much of a surprise to him as anybody, for he had no background in firearms design. Indeed much of his early work was centred on electricity; but the history of technological improvement is littered with accidental geniuses such as Maxim. What he did was to create a machine that in its day was regarded as being almost as fearsome as nuclear weapons are today, a device which would prove so efficient at killing that Maxim forlornly hoped that it would 'serve to prevent wars' (Maxim 1915: 6). In fact, it was to prove the ultimate killing machine on the World War I battlefields of France and Flanders, causing an estimated 80 per cent of the casualties during the Somme battles of 1916 and ultimately resulting in a branch of weapons technology that would see service in every conceivable role – on land, sea and air – up to the present day. How this came about is the subject of this book.

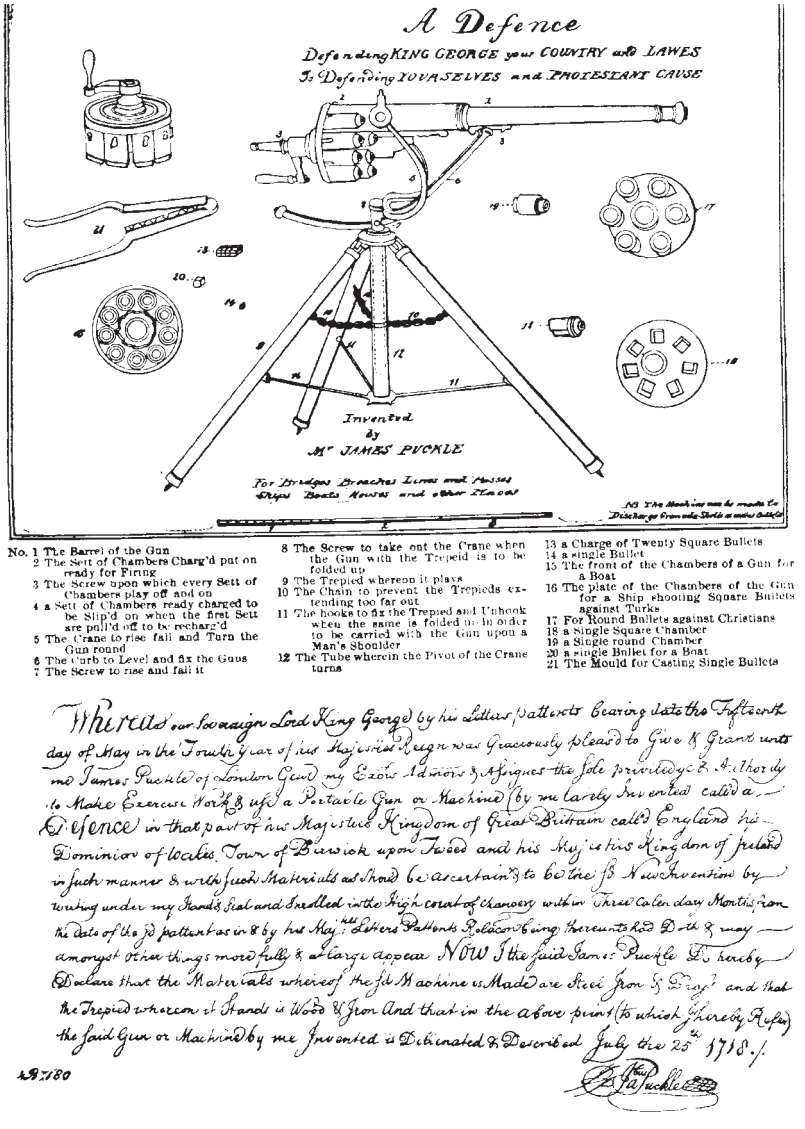
DEVELOPMENT

The search for the perfect mechanism

ORIGINS

In the 18th century, where linear warfare was still the method by which all wars were fought, the perceived need for an automatic gun was not perhaps as obscure as it may first appear. Speed of loading and firing was paramount on the battlefield and accuracy was relatively unimportant at the sub-100yd ranges at which battles generally occurred. The side that could hold its nerve, load and shoot the fastest generally won the day, by the simple virtue of putting more lead into the enemy than he was able to withstand. Any device that increased the ability of the common soldier to fire above three or four rounds per minute was certainly desirable and many firearms designers and manufacturers had tried and failed to create weapons capable of such a feat.

The first that history identifies was a Scot, William Drummond, who on 17 May 1626 was granted a patent for a machine that mounted 50 musket barrels fastened together like the spokes of a wheel '... in such a manner as to allow one man to take the place of a hundred musketeers in battle'. Sadly, it is not recorded whether this was ever manufactured – or, if it was, how efficient it proved to be – but shortly afterwards an inventor named Dudley Palmer presented to the Royal Society a paper outlining the theoretical possibility of using recoil and the force generated by the burning gas in a barrel to automatically load, fire and reload a weapon using a seven-barrelled gun designed by one Caspar Calthoss. Alas, this proposal was probably two centuries ahead of its time, for in the 17th century the technology was barely extant to bore a barrel straight, let alone make one so tightly fitting for its bullet that it would be possible to trap the propellant gas, most of which was visible as the wasted flame and



A broadsheet for the patent of the Puckle gun, showing the square and round chambers. Aside from the obvious mechanical shortcomings of a flintlock machine gun, the basic outline is not dissimilar to that of a modern machine gun. (Royal Armouries)

smoke that were emitted during firing. While not technically feasible at the time, Palmer's ideas were important and the concept was certainly to re-surface in the future.

Work continued unabated towards realizing the dream of automatic fire and it is arguable that the laurels must go to James Puckle (1667–1724), London gentleman, inventor, lay-preacher and alchemist, for the production of the first workable machine gun. Today, Puckle would probably be considered a candidate for professional mental care because of his many bizarre beliefs, prominent among which was that separate firearms should be used against Christians and Muslim Turks, the latter of whom he reviled for no discernible reason. The result of this and his considerable mechanical ability, was the Puckle gun, patented on 25 July 1718, which was in effect a giant revolver mounted on a tripod, with a

crank handle that rotated the seven-shot cylinder. It was flintlock-ignited but had the charming distinction of being supplied with two patterns of cylinders, one chambering round ball for use against Christians and the other firing square bullets for use against Turks.

As can be imagined, there were a number of drawbacks to such a contrivance; the flintlock mechanism was self-cocking but notoriously unreliable, fouling of the pan and ignition hole was frequent, and the accuracy of firing square shot (each bullet was actually cast in four pieces, producing a shotgun-like effect) through a round barrel is hard to envisage. Although much derided, both at the time and subsequently (a satirist of the day commented that the only known casualties of Puckle's gun were those who owned shares in his company), Puckle's device was perhaps the first realistic attempt at making a working repeating firearm, albeit limited by the available technology of the time.

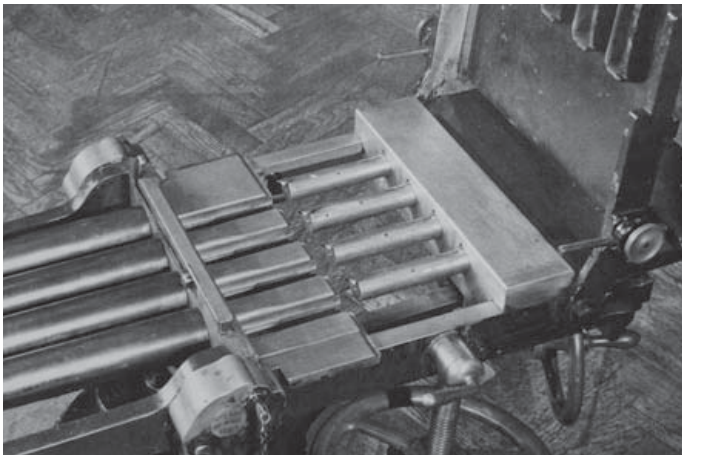
INTO THE 19th CENTURY: MONTIGNY TO GARDNER

Through the subsequent centuries, a few attempts were made to improve on the existing designs of machine-operated guns but there were few successes, although great strides were made in areas such as manufacturing technology, with improved steel quality, mechanization of production and the ability to mass-produce rifled barrels of uniformly high quality. In 1859 a Belgian, Joseph Montigny, produced a workable machine gun that had 37 barrels inside a round steel casing; this weapon used a pre-loaded breech-block chambering 11mm brass-foil needle-fire cartridges. Unfortunately all the barrels fired simultaneously, limiting its efficiency, although later models fired in staggered sequence. It could shoot at a theoretical 250rpm (rounds per minute) but, mounted on a huge wheeled carriage, it weighed some 2,000lb and was unwieldy in the extreme. Still, while not entirely practical, it certainly indicated the way forward for future development and a few examples were to be used with some effect in the Franco-Prussian War of 1870–71.

However, it was to take another conflict, this time between the Union and the Confederacy, to generate new interest in automatic weapons. The American Civil War (1861–65) saw the biggest advances in firearms design in any single period before or since. It began as a war where many soldiers still carried smoothbore flintlocks or percussion muzzle-loaders and ended with the use of metallic cartridges, breech-loaders, repeating rifles and machine guns. It proved, if nothing else, what could be achieved with weapons development given sufficiently strong demand and fewer financial limitations. During the years of the conflict, two machine guns appeared that would lay the foundations for their descendants right up to the present.

The first, by a year or so, was the Agar. Although barely known now, it was a simple single-barrelled weapon that incorporated many features of modern weapons and remains in history as the first machine gun ever sold commercially. Designed by Wilson Agar, it was a hand-cranked design of .58in calibre; it used a hopper to hold its cartridges and it bore

a striking resemblance to the common coffee-grinder, so was inevitably known as the 'Agar Coffee-Mill'. The combustible paper cartridges were held in pre-capped metal tubes; these were ejected once fired and then reloaded and placed back in the hopper. In its original form it could fire at more than 250rpm and when exhibited to President Lincoln, so excited him that he ordered ten at the then-colossal total cost of US$13,000 (£216,000 or US$352,000 at today's value). The rate of fire proved problematical, though, for the barrel overheated quickly and it was difficult to keep up a steady supply of ammunition. Despite Agar's supplying quick-change spare barrels and limiting the cyclic rate to 110rpm, the barrel still overheated, so a forced-air cooling system was devised, using air from a fan turned by the crank handle that was pushed through a cooling tube over the barrel. These improvements were never entirely satisfactory, however, and although 60 were purchased, few Agars were ever used in anger by the Union Army.

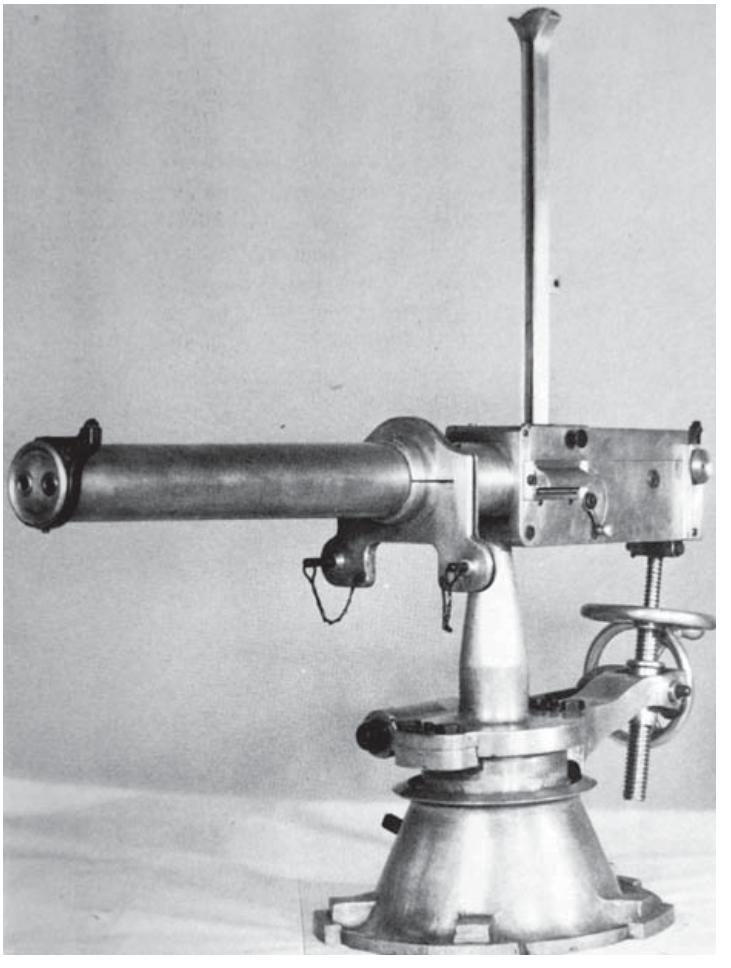


The complex breech mechanism of a Nordenfelt showing the breech blocks and firing pins. The gun quickly became very fouled and required continual cleaning to function properly. (Royal Armouries)

Of perhaps greater significance was a gun that appeared in 1862, designed by a North Carolinian, Dr Richard Gatling (1818–1903). A physician as well as a talented inventor, he had an oddly humanitarian interest in firearms, for he wrote that having watched every day the wounded, sick and dying being brought from the battlefield, it occurred to Gatling that 'if I could invent a machine – a gun – that would by its rapidity of fire enable one man to do as much battle duty as a hundred ... it would to a great extent supersede the necessity of large armies and consequently exposure to battle and disease would be greatly diminished' (quoted in Wahl & Toppel 1966: 18). This naive belief carries an echo of Hiram Maxim's later hope that such weapons would shorten war and thus ultimately save lives.

The design that Gatling developed was exactly the opposite of that being produced by revolver designers of the period, for while they were abandoning the concept of clusters of rotating barrels in favour of a short cylinder and single barrel, Gatling's design adhered to the former principle. His genius was in realizing that the generation of a high rate of fire presented specific problems to be solved. Chief among these were the need to cool the barrels and the need to ensure that there was sufficient ammunition available.

The first issue at least could be solved fairly simply, by mounting the series of revolving barrels axially around a central spindle that was hand-rotated by a handle, giving each barrel a chance to cool before being fired again. A camming system pulled the bolt backwards, allowing loose .58in-calibre combustible cartridges to drop in turn from a circular drum magazine into the pre-capped steel chamber, where each was fired. The



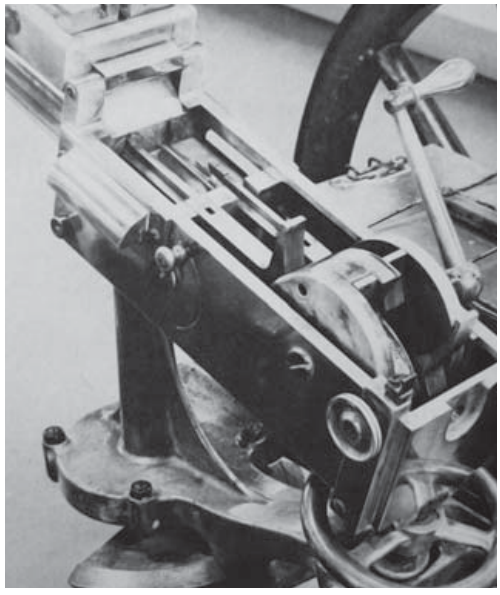
A two-barrelled Gardner. The vertical magazine relied on gravity feed and cartridges often jammed in it, but it was mechanically reliable. This pintle-mounted example was for Royal Navy use. (Royal Armouries)

Gatling generally performed very reliably, and could discharge at around 200rpm without suffering from the overheating problems faced by the Agar. It was as different from normal firearms, Gatling explained, as a mechanical reaper was from a hand sickle. One of the design's major shortcomings, the need for separately priming each chamber prior to firing, was soon overcome by the introduction of reliable rimfire ammunition, and the first use of the Gatling in earnest was during the siege of Petersburg in Virginia in June 1864. With the new ammunition a rate of fire in excess of 300rpm was feasible. Gatling also introduced two calibres – a ten-barrelled .45in gun for infantry use and a larger, six-barrelled version in 1in calibre for naval use – and was perhaps the first designer to recognize that these two branches of the armed forces had different requirements. By 1873, the introduction of centrefire ammunition enabled Gatling to raise his rate of fire to 600rpm, and in tests at Fort Monroe, Virginia, his gun was able to hit a target at 500m (546.8yd) 557 times out of 600, an impressive feat by any standard.

Of course, Gatling was not alone in attempting to develop the perfect machine gun, and a great stride forwards was made with the introduction of a gun based on a design by a Swede, Helge Palmcrantz (1842–80). His gun was of a now-familiar type, being multi-barrelled with up to 12 parallel barrels, and was lever-actuated. It was patented in 1873, but manufacture was undertaken by fellow Swede Thorsten Nordenfelt (1842–1920), who moved the company to Britain; it was under his name that the gun was manufactured and marketed. Although quite crude it was certainly effective; under test conditions at Portsmouth Dockyard it fired off 3,000 rounds in 3 minutes and 3 seconds. It was adopted in the early 1880s in 1in calibre by the Royal Navy as an anti-torpedo-boat weapon, but the design was already dated and production had ceased by 1890.

However, in connection with the story of the Maxim gun, the name Nordenfelt was to continue in a different guise, as will become evident. At about the same time the Navy had also adopted another design,

by American William Gardner (1843–87), and this bore more than a passing resemblance to the Agar, being a brass-cased two-barrelled gun in .45in calibre that used a vertical, gravity-fed magazine mounted above the breech. As was the norm, it was crank-operated, but was reliable; it certainly impressed the British Board of Ordnance when in tests at Woolwich in 1880 it fired 16,750 rounds before a stoppage occurred. The problem of cooling was partially solved by the introduction of a five-barrelled design, and it was used during the battle of Abu Klea (16–18 January 1885) in the Sudan. Despite the timely introduction of centrefire cartridges, these guns suffered from the same mechanical shortcomings, for all relied on hand mechanical operation, by lever or rotating crank handle, and their rate of fire was limited by their gravity-fed ammunition supply and the requirement at some point for allowing the barrel or barrels to cool. What was required was a method by which the mechanism could be operated automatically, the barrel kept cool and ammunition supplied by a more efficient method than hand-loaded magazines or breech blocks. The solution to all of these problems was to be found by a quiet American inventor with a passion for electricity, named Hiram Maxim.



The rotating breech mechanism of the Gardner showing the crank handle and breeches. (Royal Armouries)

HIRAM'S LIGHT BULB

Born in rural Maine in 1840, the son of a miller and woodturner, from his earliest years Hiram Maxim showed a rare ability to analyse and understand complex mechanical concepts, having a quick and very enquiring mind. The first practical outlet for this was his construction, around the age of 12, of an automatic mousetrap that used a clockwork mechanism to re-set itself each time it was tripped by an entering mouse. Although it worked perfectly it was far too expensive for production and Maxim learned an important economic lesson – that technical success had to be evenly matched with economic reality. Although interested in the concept of firearms, he was not an avid shooter or hunter but shortly after the end of the Civil War was offered the chance to shoot an issue Springfield rifle, which he did, and was surprised at the strength of the recoil. This set him thinking, to use his own words:

> … that the energy in the kick of a military rifle would be amply sufficient to perform all the functions of loading and firing, so that if the cartridges were strung together in a belt, a machine-gun might be made in which it would only be necessary to pull the trigger, when the recoil would feed the cartridge into position, close the breech, release the sear, extract the empty case, expel it from the arm and bring the next loaded cartridge into position. (Maxim 1915: 12)

A transitional gun, combining Maxim's locking crank, fusee spring and belt-feed mechanism. Note the pistol grip and trigger. (Royal Armouries)

Maxim was sufficiently intrigued by the idea to discuss the possibilities with his father, who had, in 1854, produced his own design for a lever-actuated automatic gun. However, his father judiciously pointed out that with the available technology the resultant weapon would be far too complicated and expensive and 'would not be employed as a military weapon, though it might be a mechanical curiosity' (Maxim 1915: 15).

Maxim did not pursue it, for his fertile mind was already busy elsewhere, as he was heavily involved in the new science of electricity. He had filed his first patent in 1866, at the age of 26, which was for an improved electric hair tong; over the next 18 years he patented another 84 inventions, most of which employed electrical mechanisms of some type. By far the most significant, and directly related to the later production of the machine gun, were his 1880s patents for electric lamps. By this time he had, in fact, beaten his rival Thomas Edison (1847–1931) to the goal of producing the first practical incandescent light bulb, and for good measure the next year he patented the first efficient current regulator, once again relegating Edison to second place.

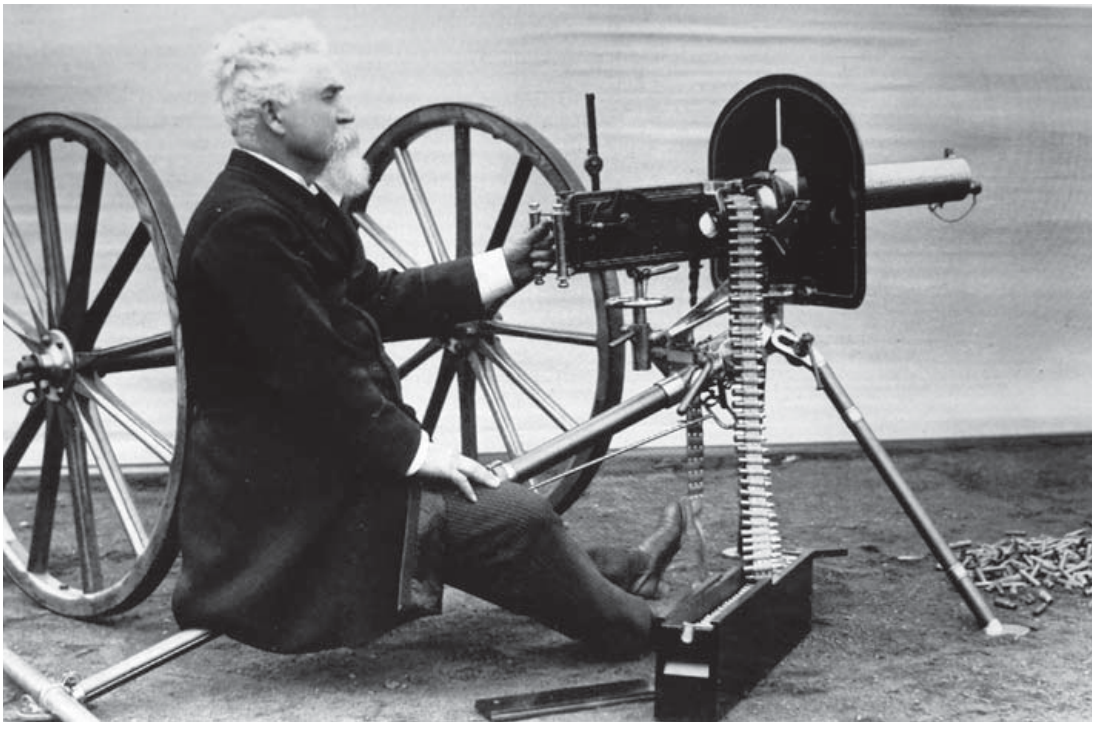
This was not good news for Edison's financial backers, who took the unusual step of offering Maxim employment as a roving technical advisor in Europe, but on the firm understanding that he cease all work on his own electrical inventions for a period of ten years. The carrot for this move was the incredible salary of US$20,000 per year that they offered, for in comparative income terms this equates to US$488,000 (£300,000) today. Thus in 1882 Maxim found himself of independent means, with a remit to travel the world, although he had little idea of where to go, or what to do. On 22 July 1896, in an article in *The Times* of London, he said that the idea of looking once again at weapons development came from a chance conversation with an acquaintance in Vienna. 'Oh, hang

your chemistry and electricity,' his acquaintance said. 'If you want to make a pile of money invent something that will enable these Europeans to cut each other's throats with greater facility.' Casting his mind back to his father's comments about automatic weapons being too costly, Maxim decided to resurrect his original idea, as shortage of money for experimentation was no longer a hindrance.

Maxim decided to settle in London, which he liked, although this decision was influenced in part because it was the centre of the manufacturing world in the late 19th century. Once there he began examining existing weapons designs and his first patent (British patent 3178, dated 26 June 1883) was not for a machine gun, but for a recoil-operated Winchester rifle. This was not as unrelated a move as might first appear, for Maxim was well aware that any work on machine guns would attract unwelcome interest and potentially damaging competition, so in perfecting a recoil-assisted mechanism he was subtly laying the groundwork for later developments. He was materially assisted by the fact that solid-drawn brass-cased ammunition was now readily available and the troublesome paper or foil cartridges were a thing of the past.

Having ascertained how he could use recoil to operate the breech block in the Winchester design, Maxim then turned his attention to producing a magazine-fed mechanism that used blowback, the power generated by firing the cartridge, to move the breech block rearwards after firing, returning it forwards by use of a hydraulic spring to collect another cartridge and chamber it. His problem was not so much creating a working mechanism, as finding a means by which he could reliably feed ammunition into the breech. Initially he had sewn together a double-weave fabric belt that was pulled into the feed mechanism by two metal star-wheels, and he used grooved-cased, rimless cartridges of his own design. In testing it fired six cartridges in half a second and he wrote 'I was delighted, and saw certain success ahead' (Maxim 1915: 18). He prophetically called this mechanism the 'Forerunner' and patented it, but it was to prove only the start of a lifetime of problem-solving and development work. He had to build into the breech a method of delaying its opening until the chamber pressure had dropped to a safe level, and he could not find an effective method of harnessing the waste gases generated when the cartridge fired. He came up with an unusual solution to the first problem, by using indirect gas operation via a port in the barrel that created a vacuum in a chamber, actuating a piston and rod and driving back the breech mechanism. He patented this invention on 3 January 1884; it was something of a watershed in machine-gun development, for it paved the way for a new family of gas-operated mechanisms.

It was only a halfway solution, though, and Maxim worked tirelessly at solving a myriad other problems. By 1884 he had set up a small workshop at 57D Hatton Garden in London; throughout the year he examined each internal part minutely and made endless changes wherever they were required, but his foremost problem was the poor-quality commercial ammunition he was using. (He was by this time using .45in-calibre Gatling-Gardner cartridges.) He contacted the Board of Ordnance for supplies of military-issue .450in ammunition, which was manufactured



Hiram Maxim seated at his 1887 'World Standard' gun. A belt of .45in Maxim cartridges is *in situ*, and a pile of spent cases can be seen on the floor. (Royal Armouries)

to far more rigorous standards. Although initially he asked to purchase 1,000 cartridges, he soon required several thousand more. When asked why such large numbers were needed Maxim was forced to explain the reason to the Board, but from then on he was supplied with all the ammunition he needed.

The gun used a bell-crank breech working with a coil spring, and it revolved in alternate directions to ensure a constant rate of fire. Moreover, it had a 'positive lock' breech, a recoil-buffer system and an unusual regulator-trigger that by means of an external lever could adjust the rate of fire from 2rpm to 666rpm. Naturally the faster the gun fired, the more urgent became the need for cooling, but Maxim soon determined that the only effective means of keeping the barrel at a safe working temperature was by using water, calculating that every .45in-calibre cartridge raised the temperature of 1lb of water by 1½ degrees Fahrenheit. This required 'as much heat to evaporate 1lb of water as it does 5lb of iron, [so] it will be obvious that weight for weight water is much more effective than iron in absorbing heat' (Maxim 1915: 22). The new prototype, therefore, had a water-jacket surrounding the barrel; he had several prototype guns made at Hatton Garden.

The new weapon was beautifully made, of blued steel and brass, was 5ft 2in long and 3ft 6in tall on its tripod and weighed a hefty 140lb without water or ammunition. When exhibited at the Institution of Mechanical Engineers in April 1885 it caused a sensation, and later that summer Maxim was awarded a gold medal at the International Inventions Exhibition. In practice, though, the vacuum operation was not reliable and the ammunition belts proved to be too heavy, straining the feed

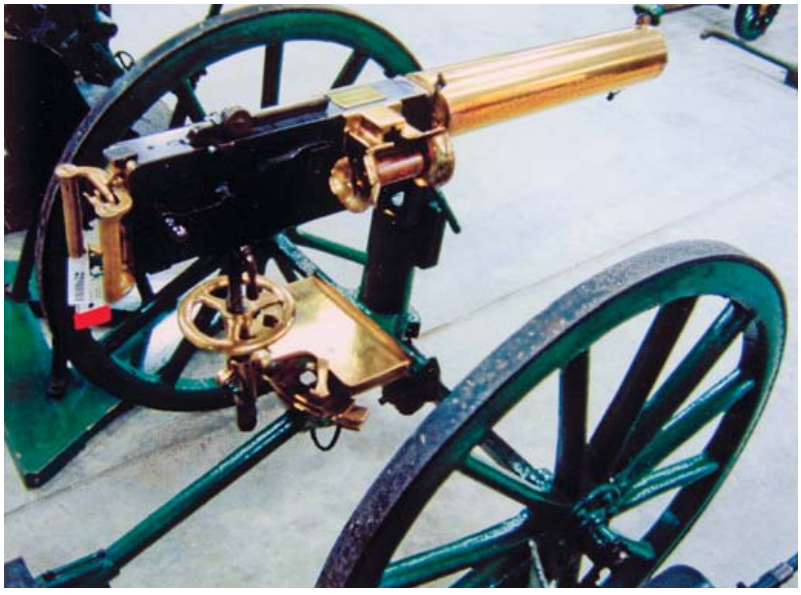
mechanism; the recoil spring was unreliable and the cartridges themselves frequently failed to ignite. Maxim also needed to find a method by which the speed of firing could be automatically restricted, and it seemed that no sooner had he found one solution than another problem cropped up.

THE 'PERFECT GUNS'

Despite these setbacks, the basic design was sound, and generally the guns performed well. Sufficient interest was created for him to form 'The Maxim Gun Company' on 5 November 1884 with the backing of a number of wealthy investors who purchased £50,000-worth of shares at £20 each. Among them was one Albert Vickers, who bought 417 shares. He and his brother Tom ran the old family steel firm of Vickers, Son & Company Ltd, and it was Albert who was elected as the chairman of the new company, with Maxim as managing director. But Maxim was still unhappy with his design, for he knew the gun was uneconomic to manufacture and required considerably more work to make it lighter, simpler and more reliable.

Maxim continued to work on the core of the design and his Patent No. 1307 of 29 January 1885 begins to show the genius of the man in being able to refine his existing design without compromising the original concept. He created an entirely new internal mechanism, abandoning the complex feed-wheels, and he also changed the fragile feed design so that a belt of loaded cartridges was now drawn into the breech by a far stronger sliding-pawl mechanism. The old lock, hydraulic pistons and vacuum devices were abandoned and replaced with a simpler crankshaft-operated breech block and short recoiling barrel, and a more energy-efficient, wound-steel 'fusee spring' replaced the old coil spring.

The internal mechanism was now very different from that of his original design. The breech-block design was unique, being fitted with a vertically sliding breech-face that on cocking was able to extract a cartridge, chamber it and prepare to extract a second by means of one cocking movement. The block itself ran along a pair of cammed tracks in each side-plate and this provided the lift required for the breech-face, enabling it to extract, feed and eject. When the trigger was pulled the cyclic action was able to continue without further human intervention. With each shot the barrel and breech block were pushed backwards simply by the force of the exiting bullet; this movement was arrested by the fusee spring, which was attached to a short chain and cam on the left side of the receiver, to help absorb the rearwards motion of the breech block. The spring would reach the limit of its travel then contract, pulling the block sharply forwards to enable it to once more chamber its freshly extracted cartridge. When firing, the breech block was locked in place by a toggle mechanism much the same in function as a human arm or knee joint. It folded easily under rearward pressure of the barrel, but once straightened by the pull of the fusee spring it locked rigidly until the next round was fired. It was at the same time mechanically complex but extremely simple, using a single, fluid motion to perform several actions.



One of the first 'Perfect Guns' on its wheeled carriage. Its beautiful construction is evident, from the polished brass jacket, ammunition box tray and spade handles to the mahogany roller on the side of the feed block. It represented Victorian engineering at its finest. (Royal Armouries)

FIRST ORDERS

At this point, Maxim was given some very sage advice by Lieutenant-General Sir Andrew Clark, Inspector of HM Government's Fortifications. Clark told Maxim to ensure that his guns were so simple that they could be stripped, checked and cleaned with no tools whatsoever, apart from a pair of hands. Only then, he said, would they prove of any interest to the military. By March 1887 Maxim had produced three prototype .45in-calibre weapons for testing, using his own solid-drawn ammunition, based on the .450in Martini-Henry Service round. The first two were water-cooled at 60lb each, while a third was a 'lightweight', air-cooled model at a mere 40lb; this particular model was crucial, for the British Government had stipulated that any machine guns submitted for testing should weigh 'no more than 100 lbs [and] should be able to fire 400 shots in one minute, 600 shots in two minutes and 1,000 shots in four minutes' (Goldsmith 1989: 39). They must also pass strenuous dust, mud and rust testing and

A Maxim-Nordenfelt of about 1889 on a rare 'Carriage, Parapet'. This enabled the gun to be wound upwards on the ratcheted track to fire over the top of breastworks. In reality, it was impractical and too expensive to manufacture. A simpler version was introduced in limited numbers in 1915. (Royal Armouries)

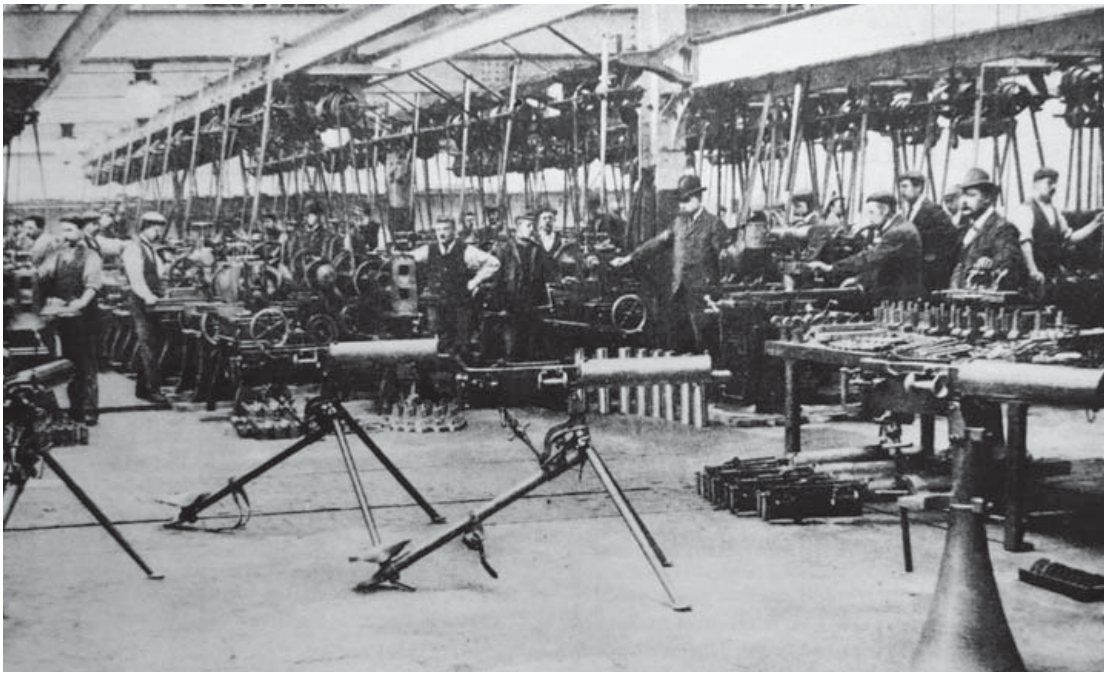
be capable of being field-stripped using no special tools. As Maxim wrote later, 'I introduced the belt ... I pulled the trigger and cartridges commenced to go off at the rate of about 670 a minute. Both regular and lightweight guns were accepted and paid for by the Government, and this was the commencement of my success as a gun maker' (Maxim 1915: 27).

The British Government placed an order for six guns in March 1887 and later that year Maxim and Albert Vickers attended a machine-gun field test at Thun in Switzerland, where Maxim's lightweight gun was to be pitted against those developed by Gatling and Gardner, and an improved Nordenfelt. It should have been a foregone conclusion, as the Swiss Army had already decided on the Gardner, but despite the Maxim being chambered for the somewhat underpowered 11mm (.43in) black-powder round, it held its own. The crucial test was the requirement to fire at 1,200m (1,312yd) at a representative artillery battery, which was further than the weapon's sights were graduated, so Maxim quickly calculated the bullet trajectory and using some careful guesswork fired a full belt of 333 rounds.

The result astonished the observing officers, one of whom approached and said, 'No gun has ever been made in the world that could kill so many men and horses in so short a time' (quoted in Maxim 1915: 31). Presciently, following a further demonstration in Vienna, Field Marshal the Archduke William Franz-Karl of Teschen (1827–94) was unusually silent. He finally turned to Maxim and with a shake of his head murmured 'It is the most dreadful instrument that I have ever seen or imagined' before departing (quoted in Goldsmith 1989: 42). He was perhaps one of the first people to understand the terrible potential of the new gun. Nevertheless, financially the demonstrations were an unqualified success, for the result was an order for 26 guns from Italy, priced at £250 each (inclusive of 10,000 rounds of ammunition per gun). The Austrians ordered 131, these being discounted to £215 each (roughly £18,700 or US$30,200 at today's values).

Clearly, an order this large was impossible for the tiny Maxim Gun Company to meet without greatly enlarged premises, so the Hatton Garden workshops were reluctantly vacated and despite considerable misgivings Maxim entered into an agreement with the Nordenfelt company to help manufacture the guns required; this was formalized on 18 July 1888, when the old Maxim Gun Company was wound up. The agreement between Maxim and Thorsten Nordenfelt was uncomfortable for both parties; Nordenfelt was reduced to making a gun that was superior to his own design and Basil Zaharoff, his sales manager, did all he could to sabotage the amalgamation. Maxim did not entirely approve of the manufacturing methods used by Nordenfelt, which he felt did not produce the quality he required. Nevertheless, additional new premises were found for Maxim at a small factory site in Crayford in Kent and this, allied to the 10-acre facility at Erith occupied by Nordenfelt, gave the new Maxim-Nordenfelt Company unparalleled manufacturing ability.

The contracts for the new weapons kept coming, for the first British order on behalf of the Crown Agents in Natal was placed on 29 March 1889, and this was followed by several more War Office contracts as well



Maxim's Crayford works in about 1892. (Vickers Archive)

as orders from the governments of Germany, France, Australia and Spain. In fact the demonstration to the Kaiser nearly altered the course of world history, when at Spandau Arsenal in the spring of 1888, the auto-traverse mechanism on the Maxim gun being fired by the Kaiser was accidentally activated so that the whole gun began to revolve of its own accord. The Kaiser would have mowed down the entire German General Staff and every spectator had Maxim not leapt forwards and disconnected the mechanism. Shortly afterwards, the mechanism was quietly dropped from the list of options.

The subsequent order from Germany proved crucial to Maxim's success, for in 1888 it resulted in a 20-year sales agreement with the vast Krupp organization, and in 1892 in a seven-year agreement between himself and a machine manufacturer and toolmaker named Ludwig Loewe of Berlin that enabled the Maxim gun to be manufactured under licence. Unknown to anyone, this was to have far-reaching consequences in the very near future. The year 1891 was also something of a landmark, for the first Enfield-manufactured Maxim was produced, the first of 2,568 to be made at the arsenal.

INNOVATIONS IN AMMUNITION

Despite the success of the 'Perfect Guns', Maxim would not rest, for he was convinced he could improve still further on them. He now referred to these production guns as the 'World Standard Maxim Gun' but many of his current problems resulted from events beyond his control. The early guns had been designed around the .45in-calibre Gatling-Gardner round, a powerful black-powder cartridge with heavy bullet that generated

tremendous recoil, highly suitable for operating the mechanism on the weapons. Maxim's own variant of the Martini-Henry round, the .45in Maxim, was also perfectly suitable, as converting the 11mm (.43in) barrels simply called for a machining modification to the breech.

The problem lay with the new smokeless powder invented by Paul Vielle, for the new smaller, lighter bullets achieved far higher velocities than the old conical lead ones, the 8mm Lebel adopted by France reaching 725m/sec (2,380ft/sec) as compared to the 435m/sec (1,430ft/sec) of the 11mm Mauser, but they generated far less recoil. Within an almost indecent space of time, almost every army in Europe had followed the French and changed over to small-calibre, high-velocity ammunition. Indeed, the Swiss Government order specified an 8×50mm Service cartridge for use with its Maxims. (In 1911 the Swiss changed to the 7.5×54mm cartridge.) While the new ammunition had greatly improved range and accuracy, and expunged all of the problems associated with fouling, it posed Maxim with a conundrum, for the recoil forces were simply insufficient to generate the power required to automatically re-cock the mechanism on his guns. However, he was astute enough to appreciate that the future of firearms design lay with the new cartridges, so he was forced to recalculate the operating parameters for the guns to deal with the reduced recoil energy of the smokeless cartridges; by the start of 1890 he had managed to do this successfully.

Vickers-Maxim ammunition. From left to right: a .450in Martini rolled-brass cartridge, a .45in Gardner-Gatling, a .45in Maxim and a Mk VII .303in. (George Yannaghas)

THE VICKERS YEARS

Maxim did not have the field of machine-gun design entirely to himself, for in the final decade of the 19th century other efficient designs were being perfected. In 1894 Austria-Hungary had adopted the Maschinengewehr Modell 1893, which used a peculiar delayed-blowback mechanism and had a cyclic adjuster that enabled the rate of fire to be adjusted, not unlike the first Maxim. France had introduced the air-cooled, gas-operated 8mm Mitrailleuse Hotchkiss Modèle 1897 – the designer of which, Laurence Benet, was coincidentally also American – and in 1895 there appeared a new threat from the Browning brothers in the United States, in the shape of the gas-operated 6mm Colt machine gun.

Nevertheless, Maxim's guns continued to sell well, but the rift between Maxim and Nordenfelt was growing. Among other models Maxim had

designed was the popular and large-calibre 'pom-pom' gun, so called because of the noise it generated when fired. Chambered for a 1lb (or 37mm) armour-piercing or high-explosive shell, it was more correctly an automatic cannon rather than a machine gun, although the mechanical principles were the same. Made jointly with Nordenfelt, some 35–40 guns were produced in 1895–96 and it appeared to a casual observer that the joint company was proving highly successful, but the truth was very different; orders for Nordenfelt's own guns had slowed to almost nothing and the company had expanded far too quickly, overstaffing the Erith works. By 1897 their finances were in dire straits.

At this point, the interest expressed by Maxim's partners, the Vickers brothers, became more apparent. In 1888, in the wake of receiving a large order from the British Admiralty for large naval guns, Vickers had realized that they were, to quote the official history, 'occupying a half-way house' (Richardson 1905: 10) in industrial terms. They were, as their history states 'predominantly a steel manufacturing firm, with one foot in armaments' (Richardson 1905: 12). With the rapid expansion of British naval power to match that of Germany, the Vickers brothers understood that while naval armaments, specifically engines, armour plate and guns of huge calibres, were well within their scope to manufacture they could also see the sales potential of the new breed of smaller automatic guns. As a result in 1896 they paid £1,353,000 (today, equivalent to £117,000,000 or US$190,557,000) for the Maxim-Nordenfelt Guns and Ammunition Company. From 1 October 1897 the new company was called Vickers, Sons and Maxim Ltd. To realize their dream of producing something larger, they also purchased the Barrow Shipbuilding Company. They would soon be in the unique position of producing both Dreadnoughts and machine guns.

In 1899 Maxim had ceased to be the company's managing director, the position being taken by Sigmund Loewe, the brother of Ludwig. The start of the 20th century was a momentous time for Hiram Maxim, for in 1900

A Model 1906 'New Light' gun, the first of the Vickers family, later adopted as the class 'C' gun. Its standard tripod proved too fragile and awkward in use and later models adopted the ubiquitous Mk IV tripod. (Royal Armouries)

A Vickers and captured German MG 08 providing support fire at Mouquet Farm on the Somme, late summer 1916. Crews of both weapons and the photographer are taking great care to stay below the skyline, indicating the enemy are not too far distant. Use of captured German machine guns was routine, as their mechanical systems were almost identical to the British weapons. (IWM Q 1419)

he became a naturalized British subject and the following year was knighted for his services to the Empire. In 1902, Vickers signed an agreement that prohibited Maxim from undertaking any further work on his designs in return for a handsome fee of £1,200 per year (£102,000 or US$166,500 today) and although Hiram initially oversaw the continued development of these rifle-calibre guns, he was increasingly being distracted by other newer technology, in particular powered flight. Until 1911, all Maxim guns manufactured were marked 'Vickers, Sons and Maxim Ltd' but this ceased by 1912. All later development work on the design was undertaken by Vickers engineers, under the aegis of Sir Arthur Trevor Dawson, an ex-naval gunnery specialist who was to become the most senior and influential figure in the company.

The guns produced after 1889 were chambered for modern high-velocity rifle calibres and were now capable of an average rate of fire of 450rpm. They were instantly recognizable with their handsome but heavy brass water-jackets, but their early use in colonial wars had raised some questions about reliability. One of the greatest shortcomings was in the lock design, for it was almost impossible to replace a firing pin or spring without workshop facilities; neither could headspace[1] be accurately adjusted for the cartridge. As a result, each gun had to be supplied with three locks, which were only usable with that specific weapon. The feed block also caused problems, for it was heavy, awkward to remove or replace and had a vulnerable wooden roller; overall, the guns were regarded as still being too heavy.

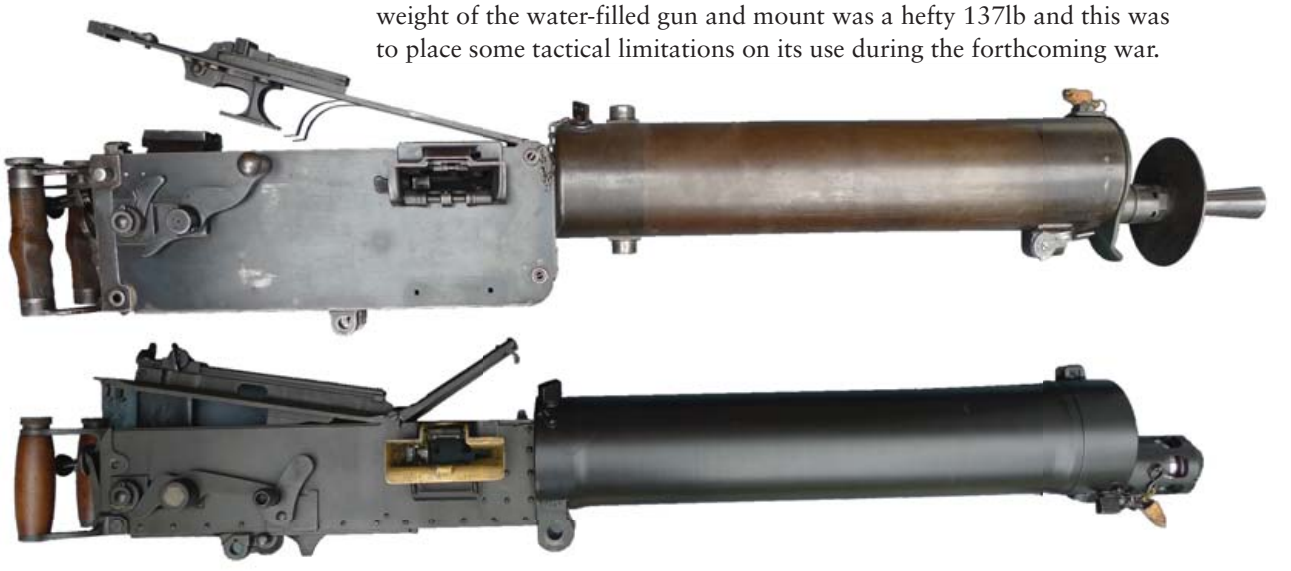
In their first major revision of the design, Vickers brought out the Model 1901 'New Pattern', which addressed all of the existing problems. Most significantly, the brass water-jacket was changed for a lighter rolled-steel one and the lock was much simplified, being field-strippable in seconds with no special tools. A method of headspacing was devised using thin steel washers that could be added to the connecting rod of the crank. It was simple, accurate to set up and efficient. The feed block was lightened and produced entirely in brass and steel, and a host of smaller but equally important changes were made to simplify the design and the mounting system. Although this pattern was in production for five years, all guns ordered in 1902 by the War Office were inexplicably specified to be the brass-jacketed 1893 model.

1 This is the permitted tolerance between the face of the breech block and the base of the loaded cartridge – too little and the cartridge slams backwards on firing, causing stress and heavy wear; too much and the base is compressed, leading to difficult extraction and jamming.

IN GERMAN SERVICE

The pre-1914 years were to prove to be turbulent ones for the development of the new Vickers Company, for the seven-year manufacturing agreement with Ludwig Loewe in Germany expired and there was a scramble for licensing of the commercial manufacturing rights relating to the guns. In 1896 Loewe had formed a new company, Deutsche Waffen- und Munitionsfabriken (DWM). He had been making a copy of the Model 1894 Maxim, which was adopted by the German Navy, and he copied the Model 1901, which was purchased by the German Army, who equipped 16 machine-gun detachments, so that every army corps incorporated a Maxim detachment. German observers of the Russo-Japanese War (1904–05) saw at first hand the devastating effects of the fire from these guns on attacking infantry, but also began to appreciate the shortcomings of the existing designs.

Some of the German modifications were, to say the least, a curious mix of the practical and puzzling. The Germans immediately set about improving the design of the Model 1901 by reducing its overall weight, eliminating the awkward and heavy tripod in favour of an equally clumsy and heavy Schlitten 08 mount (sledge mount). Inexplicably, they ignored the improved 1901 lock, opting to retain the old non-adjustable 1889 design, which meant that only trained armourers could headspace the locks and resulted in all World War I-production sledge mounts being manufactured with stowage boxes to accommodate two spare locks. Cold-weather performance was sometimes poor, due to internal resistance from parts stiff with frozen oil, so a muzzle booster was added; this increased the recoil force on the barrel, improving the performance and marginally raising the rate of fire from a relatively slow 350rpm to a more respectable 450rpm. Unlike the British, the Germans also added a side mount on to which a telescopic sight, the Zielfernrohr 1912 (Zf 12), was fitted; oddly, no optics were ever provided for the Vickers guns. The mechanical function of the new guns was unaltered from the early model and it was adopted as the Maschinengewehr 1908 (MG 08). The total weight of the water-filled gun and mount was a hefty 137lb and this was to place some tactical limitations on its use during the forthcoming war.



A comparative photograph showing the size difference between the receivers on an MG 08 (top) and a Mk I Vickers, and the different placing of the cocking handles. The feed blocks are also of different patterns and the top covers are partially opened for comparison. (Author)

A 1908 Light Pattern Service Vickers mounted on its 'J' pattern tripod. The arched rear-sight bridge and complex traverse and elevation mechanism can be seen clearly. The long rear leg of the tripod proved to be too awkward in use, and few 'J' pattern tripods ever saw British service. (Vickers Archive)

TOWARDS THE MODEL 1908 LIGHT PATTERN

Meanwhile, the Vickers engineers were still wrestling with the problems of making their guns lighter and more efficient; they brought out the improved but short-lived Model 1906. This bore many of the visible hallmarks of its later, more famous sibling, notably the corrugated water-jacket and ventilated muzzle booster, and used weight-saving metal alloys wherever practical. The booster design improved the cyclic rate and helped cut down on fouling, although a 'C' spanner was required to remove it when barrel changing, which the German variants did not. It reduced the weight to one-third that of the original brass-jacketed 1893 models – 56lb. A safety bar was added to the trigger mechanism, making accidental discharge much less likely. Despite these advances, sales of the new model were disappointingly slow and after three years it was discontinued, making it one of the rarest of the Vickers models today.

Understandably, Vickers was unhappy, for the new model should have proven an unqualified commercial success, but it was still too close to its German competitor and was also slightly more expensive. Under Dawson's leadership and with the considerable help of chief engineer George Buckham, it was decided that an entirely new approach should be taken, so rather than making piecemeal modifications, the entire functioning of the mechanism was altered by turning it upside down. This meant that the crank now broke upwards, as opposed to downwards in the previous models, thereby enabling the depth of the side-plates of the gun to be reduced by almost 2in, while at the same time the use of improved steel enabled them to withstand greater torsional stress and use a lighter receiver. For the gunners it meant the odd sensation of cocking the gun by pulling back on the cocking handle, instead of pushing it forwards and allowing it to fly back. The top cover was made in two parts, so the feed block could be removed separately, and the block was also lightened at the same time. A new radial pattern rear sight was designed for the rear feed-block cover. This new gun was designated the Model 1908 Light

Pattern Vickers and it was an immediate commercial success, becoming the longest-serving machine gun in the history of the British Army.

In addition to the gun, a new tripod had been devised for Service use. Earlier Vickers-made patterns, which ran through the 'A'–'H' Patterns, were extremely complex, some being fitted with an armoured shield and others on wheeled mounts. Later models such as the 'J' Pattern used a crank handle to raise the gun and its cradle for shooting over obstacles, but all were considered by the British Government – with good reason – to be too expensive and unnecessarily complex. Trials guns were equipped with Mk I and Mk II tripods, which were of a much simplified design and construction; however, in 1906 the Small Arms Committee[2] decided that a new 'Mount, Tripod Mark IV' would be supplied in future with all Service Vickers guns. Although not as glamorous as the guns, the tripods were vital for the functioning of a Vickers, and the Mk IV was a triumph of simple design.

The Mk IV consisted of a brass cradle into which the body of the gun was locked by a cross-pin in the centre and another connected to the elevating mechanism at the rear, which was raised or lowered by a brass wheel. The arm and elevating gear dropped into a heavy cast-brass central socket which had three steel legs attached to it – two shorter at the front, one longer at the rear – which were locked by quick-release levers. On top of the socket was a brass degree dial, marked in 360-degree angles, and the design potentially provided the gunner with an unlimited arc of fire – unlike the MG 08, which was severely restricted due to the mount design. It was immensely robust, easy to assemble, dismount or repair and could be carried by one man, with the tripod and rear leg hanging down his back and the two front legs splayed over his shoulders. The downside, however, was its weight, a hefty 56lb. These tripods were initially manufactured by external contractors, Vickers being unable to produce them with the other demands it had to meet, but during World War I, Vickers-made tripods were manufactured in large numbers.

THE LIGHT PATTERN IN BRITISH SERVICE

In the summer of 1910, the new Light Pattern was demonstrated to the British Army at the School of Musketry, Hythe, and an initial, favourable report was submitted to the Small Arms Committee. As a result, 26 trials guns were ordered, the first being received in May 1911; the type was then trialled alongside the existing British Maxims as well as German-manufactured DMW 1909 commercial models, each gun having 10,000 rounds fired through it. The report (SAC 1197) is long and very detailed but its conclusion was inescapable – the new gun was an unqualified success. Compared to other models the feed block could now be stripped without disturbing the rest of the mechanism and it was far easier to replace broken firing pins or springs. The use of badly filled, soaked, or

2 The Small Arms Committee was formed in March 1854 'to consider the cheapest, most expeditious, and most efficient mode of providing small arms for Her Majesty's service' (Goldsmith 1994: 25)

Some idea of the colossal quantities of ammunition required by the machine guns can be gleaned from this photo of a stockpile of .303in ammunition in the charge of New Zealand machine-gunners in France in May 1918. There are about 100,000 rounds visible, enough to keep only a single gun firing during a night barrage. (Wellington War History photo Turnbull Library G-133211/2)

mud- and sand-covered belts did not materially affect the functioning of the feed mechanism and in terms of mechanical reliability all that could be found wanting after 10,000 rounds was a loose pawl spring on one gun and barrel wear resulting in a drop in bullet velocity of 200ft/sec. The report noted:

> The chief points in [its] favour being:
> a. Its lightness
> b. The various advantages in mechanical details. Its great superiority in ease of stripping and exchanging broken or damaged components. (SAC 1197)

Adoption of a new Service arm was always a tenuous process, and further tests were undertaken on 8 February 1912; these raised two hitherto unmentioned concerns. The peculiar (and nearly unpronounceable) radial pattern Peddie-Calochiopulo aperture rear sight and its tubular fore sight were thoroughly disliked, as was its graduation to only 2,000yd. As a result a tangent rear sight, graduated to 2,500yd, and blade fore sight were adopted. Potentially more serious was the apparent defect of the sliding cover plate in the floor of the receiver, through which the empty cases dropped. This was a standard design feature and, after such thorough testing, why it should suddenly become a matter of concern with the Small Arms Committee is inexplicable, but their letter to Vickers was blunt:

> An examination of the light Vickers Maxim sent for trial reveals a serious structural defect. The bottom of the breech casing has to be kept open during firing, thus exposing the heavily oiled parts of the mechanism to the action of dust and sand. This is clearly such a grave defect that there is a question as to whether it is worthwhile expending ammunition in trials … (SAC 1197)

This threw a large spanner into the works in terms of the gun being adopted for Service use, and in a letter dated 16 March 1912 Vickers responded with a restrained and carefully worded explanation:

The Machine Gun Company of the 2nd Coldstream Guards, with a Barr & Stroud rangefinder in the centre of the photo. Their early Vickers-Maxims are on Mk IV tripods, suggesting this picture was taken in about 1915. (Peter Smith)

> We beg respectfully to submit that in our opinion dust or sand entering the light pattern gun through the open bottom casing during firing is less likely to impede the working of the gun than the dust and sand which enters ... during travelling as in addition to the feed block being open, the Service gun also has the ejector tube through which foreign matter can enter. As this ... would be boxed in with the mechanism of the gun, it would be churned up by the rapid motion of the same and as there would be no means of escape it would in time get into the working surfaces and might even get into the chamber.

In other words, it hasn't been a problem up to now and won't be in the future, and so it proved. Still, the acceptance process dragged on, with yet another series of tests at Hythe, resulting in a further list of 27 suggested improvements from the School of Infantry, about half of which the Small Arms Committee agreed with. Vickers were quick to respond and many of the modifications were quite simple. These included: the introduction of the new rear sight; modifying the elevation gear to include a hand-wheel; enlarging the crank-handle knob to provide a surer grip; giving greater clearance on the grip-handles for the firer and including an oil reservoir internally; thickening the flange to give better sealing against steam escape on the muzzle; and slight modification of the bottom sliding plate – although oddly, the apparently insurmountable problem of the sliding cover itself was not mentioned. Trials by the British Army in India, which included heat and dust tests, brought forth no real concerns that had not already been addressed, aside from a dislike of the early Mk II tripod. Finally, on 26 November 1912, Britain officially adopted the 'Gun, Machine, Mark I, Vickers .303 inch' (LoC[3] §16217), which was to remain in service for the next 55 years.

3 List of Changes in British War Matériel and of Patterns of Military Stores (Which Have Been Approved and Sealed; With Instructions Relating Thereto). The LoC was a War Department publication from 1860.

INTO WORLD WAR I

The new gun was a considerable improvement on the old Vickers-Maxim model. It weighed 30lb less and was made entirely from high-grade steel, with every internal part being interchangeable. It would fire any mark of Service .303in cartridge, although it was sighted for the Mk VII. True, the Mk IV tripod was heavy, but far more robust and portable than the older patterns, and the 26 trials guns initially supplied proved to be virtually trouble-free. Orders were placed for the large-scale supply of guns, but there was deemed no urgency by the War Department, so when Great Britain declared war on Germany on 4 August 1914 the entire complement of machine guns in the British Army stood at a mere 1,846 Service Maxims and 111 Vickers guns (of which the Navy had two).

Initially the forthcoming conflict was not seen as one that would require the large-scale supply of machine guns, it being widely believed that it would be a short, fast-moving conflict, fought mainly by cavalry. Nevertheless, between August 1914 and June 1915 four contracts were issued by the War Office for a total of 1,792 guns. The difficulty facing them was not so much ordering the guns, as knowing what quantities were actually needed. The reality was that in the face of Germany's massive superiority in firepower, the British Expeditionary Force was clamouring for guns, to the extent that some units (the 1/4th Seaforth Highlanders, the 1/5th Gordon Highlanders and King Edward's Horse among others) actually made personal purchases of Vickers guns, paid for by their colonels.

As Minister of Munitions, David Lloyd George was charged with finding out exactly what the Army's requirements were, but repeated questions to the War Office about numbers met with vague replies and no direction as to where manufacturing priorities lay. So on 26 July 1915 he despatched Sir Eric Geddes, the Deputy Minister, to a meeting with Lord Kitchener, then Secretary for War. Geddes's question was simple enough: 'To plan production, how many machine guns did the Army require?' The response was surprising, as Kitchener exploded verbally: 'Do you think I am God almighty that I can tell you what is wanted nine months ahead?' Geddes was unimpressed and patiently explained that he needed to know how many Vickers guns should be planned for in proportion to the numbers of rifles and Lewis guns that also needed to be manufactured. In his memoirs, Lloyd George quoted Geddes's recollection:

> Then he gave me the old War Office answer. 'I want as much of both as you can produce.' Eventually he said that the proportion was to be two guns per battalion as a minimum and four as a maximum and anything above four was a luxury. That was the opinion of the Secretary for War, who was looked upon generally as our greatest soldier. (Lloyd George 1933: 92)

This was in stark contrast to German doctrine, which as far back as 1902 had determined that six guns per battalion was the *minimum* required; by 1914 the Germans had 4,422 MG 08s in service. By 1915 every regiment had three machine-gun companies with three (sometimes four) guns per

1 A Lithgow-manufactured gun, dating from 1944. Aside from its smooth water-jacket, it is identical to a World War I-period Vickers; however, it is rare in being chambered for .30-06. The water can and wooden ammunition box are World War I vintage, but disposable metal or metal/plywood boxes were commonplace during World War II. The water cans used throughout the Vickers gun's life were Army-issue petrol tins, as they were cheap and always plentiful.

2 The breech block showing two cartridges held on the breech face. When in place in the receiver, the lower cartridge would be in the breech, the upper one still held in position in the belt.

3 The cam in the left-side receiver body along which the breech face ran as the mechanism cycled. This provided it with the necessary up-and-down motion for the face of the breech block that enabled it to remove a fresh cartridge from the feed block and chamber an existing one.

4 Unlike the earlier Maxims, the Vickers had a separate top cover and feed-block cover, making barrel changing or sorting out feed problems much quicker. The rectangular item at the centre rear of the water-jacket is the filler plug for the coolant water.

5 The powerful fusee spring on the left side of the receiver with its adjuster at the extreme left. Tightening it or loosening it increased or decreased the tension, altering the resistance to the rearward motion of the breech block. This resulted in either speeding up or slowing down the rate of fire.

6 The Mk IV tripod. The angled handles (seen top left and centre) are the quick-release cross-pins that enable the gun to be dismounted from the cradle. Elevation is quickly altered by means of the wheel at lower left. While traverse is unlimited, the gun can be clamped rigidly in position by means of the traverse-check screw, visible just beneath the forward edge of the dial plate.

7 The trigger group. The wooden spade handles contains removable brushes and also hold a small quantity of oil. The centre mechanism comprises the inverted 'U' shaped safety bar and oval trigger. The bar physically blocks the trigger and has to be pulled towards the firer to release the trigger mechanism.

8 The muzzle assembly, showing the heavy conical deflector designed to prevent enemy bullets from entering the casing. Behind it, the polished gas cup is visible; this harnessed waste gas to provide the rearward motion for the barrel and crank assembly, enabling it to unlock the breech mechanism. The quick-release brass water connector for the hose is also shown and the small chain holds the cork to block the barrel aperture in the water-jacket.

9 The Mk IV dial plate, with its degrees of angle to enable precise alignment of targets when firing at long range. The dial sight also provided the same function. (All photos © author)

company, each of which was attached to a battalion of the regiment. This increased as the war progressed, albeit in a somewhat haphazard manner, so that by late 1916 some units had six guns per battalion, others as many as 25. By the end of 1917 the introduction of the 'light' MG 08/15 had provided each infantry company with three extra guns. However it was viewed, the German Army was very well equipped indeed with Maxims.

Geddes, meanwhile, was still struggling to get Kitchener to sign the authority for production and, having finally done so, showed the result to an incredulous Lloyd George:

> I had made enquiries of my own amongst the fighting soldiers who had all been in action and they were all in agreement as to the need for more and more machineguns, so that, when I read this miserable estimate, I was so indignant that I should have torn it up if Geddes had not rescued it from me. I said to him 'Take Kitchener's maximum, square it, multiply that result by two; and when you are in sight of that, double it again for good luck.' (Lloyd George 1933: 93)

Thus by nothing more than sheer guesswork was determined the number of Vickers guns to be manufactured. In July an order was placed with Vickers for the supply of 12,000 guns with spares in addition to the guns already ordered.

MEETING THE WARTIME CHALLENGE

The two immediate problems facing Vickers were that they were simply not set up for production on a wartime scale and by the time of the Geddes order (July 1915) they had still only supplied 1,022 of the original order. To compound matters further, in October 1914 Vickers-Maxim had agreed to supply 2,000 guns and 'J' Pattern tripods to the French government and the Vickers Company was obliged to honour this. Initially, Vickers believed a partial solution to their dilemma could be found by sub-contracting production to Colt's Patents Firearms Manufacturing Company at Hartford, Connecticut. A decade before, they had made some Maxim guns and still retained tooling for them, so an order for 6,000 guns was placed with them immediately after the first British Government order was received. Alas, this did little to relieve Vickers' awkward position, for three days later the new 12,000-gun contract was received! Besides, Colt had yet to tool up for manufacture and were in no position even to guess at a date by when they could begin production on a large scale.

Even late in the war, early Maxims remained in use. This photo is dated August 1916 and shows Territorials of The Norfolk Regiment with an Enfield-made Maxim. It is probably a reserve gun supplied for training purposes as the Mk I Vickers was in general service by this date. (Peter Smith)

At about the same time (22 November 1915) the United States Government decided to order 125 guns, but fortunately for Vickers, these were to be manufactured under direct contract with Colt. A second order for 4,000 guns was placed shortly thereafter, all to be supplied with the complicated 'J' Pattern tripods. These US guns were not identical to the UK versions, for they had differences in the muzzle attachments, grip frame, rear sights and of course the barrel and breech block, as all were chambered for the American .30-06 cartridge. The complicated story of these guns could fill a book in its own right, but suffice it to say that having already agreed to produce 16,000 guns, Colt realized that they too were quite unable to meet the schedule for the new contracts.

Belt filling at the Park Royal ammunition factory, London. The belts are an early World War I stripless type, identified by the wire insertion tab. Ammunition for the belts is supplied from boxes of Mk VII Ball, visible on the floor. The factory employed over 7,000 staff, mostly female. (IWM Q 31314)

The net result was that the production of the early guns was rushed and many suffered from manufacturing defects. In addition, most early guns had been poorly packed and were received by the Army in an unusable condition due to heavy rust deposits. Dipping in a grease preservative, Cosmoline, was recommended for all future shipments. The first guns reached the US Army in May 1917 and by December 1918 12,125 ground and air models had been shipped to the US Expeditionary Force in France, where they served the US Army well. Supplying the 'J' pattern tripods on time proved impossible so Mk IV tripods were substituted.

How Vickers were going to be able to meet the delivery of all of these contracts was a cause of huge concern to everybody involved. Aside from requiring a far bigger factory than currently existed, a new problem besetting Vickers was the sudden shortage of labour, as skilled men flocked to join the colours. Many of those who remained were unskilled and could not be trained quickly enough in the short term. Clearly, the Crayford and Erith works had to be enlarged and equipped, so work began in 1915 to add a new machine shop to the Erith works that raised its working area to an impressive one million square feet. Crayford was initially to produce the 2,000 French-contract guns, but at the same time it too was expanded to over half a million square feet and while it took almost seven months for the factory to manufacture 952 guns in its initial contract, it produced the next thousand in a little less than four months.

By 1916, the total output of the two plants was 1,000 guns monthly, which was barely equal to demand. Lloyd George's initial calculations on the number of guns required for the Army had resulted in a supply figure of 32 guns per battalion, with the same number available to allow for loss and damage, generally referred to as 'wastage'. These figures were theoretical, of course, but it meant that the Ministry could at least plan for an initial production rate of 50 guns per week, rising to 634 per week by mid-1916 (War Office 1932).

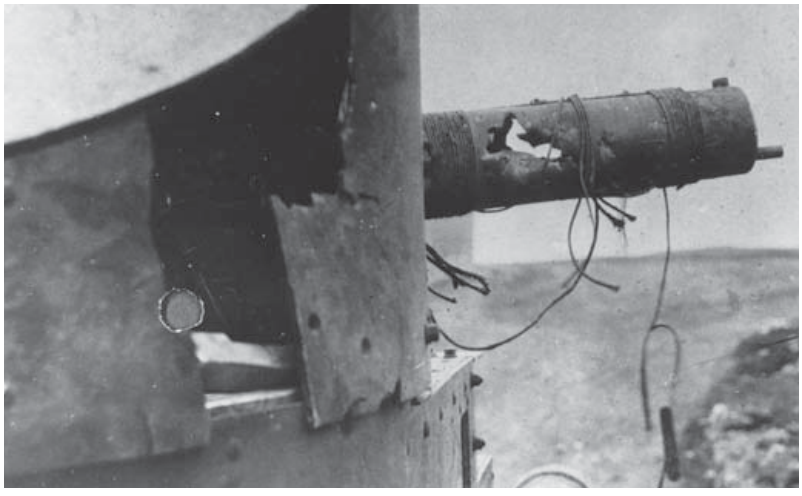
Women manufacturing Vickers parts at the Crayford works during World War I. Much of the machining was done by women, who comprised one-third of the workforce by 1918. (Vickers Archive)

The staff of the Crayford works at the end of World War I. Some 12,000 people were employed in machine-gun production. (Vickers Archive)

Unlike the German decision to equip its army with a calculated number of machine guns per unit, the British figures did not rely on any scientific basis but, in the wake of the War Office's November 1915 decision to raise the establishment of Vickers guns per battalion to 16, it turned out that they were to be only barely adequate. As Lloyd George wrote:

> ... this [number] was progressively raised by successive stages until the total number of these guns issued to the fighting forces was not far short of ... sixty-four per battalion. This included the guns issued to the Machine Gun Corps and the Air Force, and we also had ample margin for losses, which were very heavy. The numbers we had in France at the date of the armistice were the equivalent to 80 per battalion. (Lloyd George 1933: 102)

With the expansion of the fighting forces in France and Flanders, the British Expeditionary Force consisted of 70 infantry and ten cavalry divisions, requiring some 8,500 Vickers guns to be in service by 1916 – but wastage had been calculated at only 6 per cent monthly; in practice it soon became clear that with the vulnerability of the guns to shellfire the



The result of shell splinters hitting a Vickers jacket, photographed on an armoured car somewhere on the Western Front. The gun could fire for a short period with a punctured jacket but the barrel would soon overheat dangerously. (IWM Q 72874)

wastage figure was far too low. By July the War Office had revised this to 50 per cent and advised Vickers that they should plan for production of no fewer than 800 guns per month (War Office 1932) and, for 1916 alone, nearly 13,5000 Vickers guns were required.

No matter how much care was lavished on the manufacture of the guns, they were of no practical use in the field without their tripods. As of April 1915 12 different manufacturers had been issued contracts for the supply of 6,987 Mk IV tripods, at an average price of £30 each (Goldsmith 1994: 59) – £1,880 or US$3,031 at today's value. To put this into perspective, a Lee-Enfield cost £12 (£750 or US$1,220 today) – so manufacture of the tripods was expensive, but utterly necessary. The new design of the Mk IV meant that the fabrication could be done using semi-skilled labour, rather than requiring skilled machinists, as most of the parts were cast and only certain components – such as the cradle and spigot – required precision machining.

Finding companies with the necessary machinery was hard, but by late July 1915 two-thirds of the tripods had been supplied. Both Crayford and Erith made strenuous attempts to employ as many skilled men and women as possible, and female workers soon comprised over one-third of the workforce. Fabrication of machine guns became a priority, meaning that after October 1915 skilled men who had enlisted in the Army were released from military service and returned home; even so, this was still inadequate to fill the skills gap, so men working in the textile mills in the north of England were offered bonuses and housing to move south to work for Vickers. Another system was devised so that skilled workers trained their own apprentices and received a bonus of £1 for each successfully qualified worker. Unlike many of the other manufacturing companies that thrived during the war, Vickers soon developed an excellent reputation for the care of their workers, providing sports grounds, company housing, theatres and medical facilities. Crayford was fully staffed and at maximum production by November 1916; by the time of the armistice it employed over 12,000 people on Vickers production and manufacturing output had soared. Production in 1911 had been a

An oft-reproduced image of a gun crew on the Somme. The author has tentatively identified these men as belonging to the 34th Battalion, Machine Gun Corps, at La Boisselle on 1 or 2 July, giving covering fire during an attack; the Sangster tripod is quite clearly evident. It fitted to the water-jacket by means of a large screw clamp. (Author's collection)

mere 26 guns. By 1914 it was 339; in 1915 it was 2,433, rising to 7,468 in 1916, 21,751 in 1917 and 412,699 in 1918, and costs dropped pro-rata. At the start of the war, a Vickers gun with spares kit cost £165 (£6,270 or US$10,206 today); by May 1918 it was £74 (£2,810 or US$4,570), and it was expected that this would drop still further if production continued after 1918 (Goldsmith 1994: 56–57).

THE WARTIME GUNS

There has been much confusion over the manufacture of Vickers guns during World War I, in terms both of their models and serial numbering and of the various supposed differences between Crayford and Erith guns. In fact, there was only ever one mark of Vickers gun for ground service, and that was the Mk I. Guns issued to the Royal Flying Corps and Royal Air Force were designated Mk I* and would by 1918 comprise roughly 30 per cent of total production. The wartime Vickers guns made at Crayford and Erith were identifiable by their serial numbers and letter prefixes. All Erith guns up to December 1916 were 'L' series, so serial numbers began with the pre-war trials guns (L1–L26) and ran through to L9999; from January 1917 onwards, however, guns were serial-number block-marked as 'A', 'B', 'H' and 'K' series up to the end of production in March 1919. Confusingly, numbers overlap, so two Erith guns may have the same number, e.g. 1563, but one may have the prefix 'A' and the other 'B', denoting that the two weapons

were of different dates of manufacture. Crayford used a similar system, but used the prefixes 'C', 'D', 'F' and 'G' from November 1916 to December 1918; serial numbers of these guns also overlap.[4]

While the distinctive corrugated steel water-jackets of the wartime guns are regarded as exclusively of the 1914–18 period, towards the end of 1918 some 'F' and 'H' series guns were being manufactured with plain steel water-jackets, which were quicker and less costly to manufacture. But it was not only the production of the guns that proved problematical, for the supply of tripods and spares caused some headaches too. Every gun required a vast array of accessories: barrels, belts, belt-filling machine and belt-repair tools, ammunition boxes, feed blocks, water cans, spares boxes and tins, eight types of springs, oil brushes, cork plugs (for the water drain and filler holes), etc. The toolboxes held pliers, screwdrivers, hammers, cleaning rods, brushes, stuck-case clearing tools and emergency patches should the water-jacket be punctured. Every issue gun needed two brass cleaning rods, 5ft of asbestos string to pack the glands on the barrel and prevent water loss and 6ft of rubber tubing for the steam condenser with all the associated brass fittings. As the war progressed it became clear that the Army's belief that certain items would be re-used, such as ammunition belts and boxes, was quite unfounded. With a cyclic rate of 500rpm the speed with which ammunition was used meant it was impossible to maintain a supply of hand-reloaded belts, so empty belts were simply discarded and factory-loaded belted ammunition was preferred. Besides, the wooden boxes were prone to water and gas ingress and mildewed or corroded ammunition was useless. There was the additional fact that the gun crews regarded empty wooden ammunition boxes as perfect for making fires for cooking. So, in the autumn of 1915 (LoC §17669), metal tins (Box, Belt, Ammunition, MG No. 6 Mk I) began to be issued on the basis of four metal to every six wooden, and by 1918 single-use sealed tins had been introduced.

Inevitably, there were shortcomings found by the soldiers who used the Vickers guns in service, although generally speaking these were minor. Early guns had five distinctive 'arches' that supported the rear sight when folded down. These were troublesome to machine and the weight saved was minimal, so a single cut-out was used on guns after 1916. The design of the right-hand side-plate was simplified to speed up machining and the fusee-spring cover was found to jam against the tripod head at high elevation, so a triangular stop was introduced to limit its movement. An armoured cone was fitted to the flat muzzle disc, not to speed up the rate of fire as is often quoted, but because the muzzle was found to be vulnerable to bullet damage (Vickers guns were a favourite target for German snipers) and the screw-threaded muzzle cup was very difficult to remove due to heat and fouling. This resulted in a major modification to the barrel itself, which was already considered to be too light for prolonged firing, resulting in it expanding so much that it was almost impossible to unscrew the muzzle attachment without the application of a big hammer and considerable muscle. The heavier-walled Mk II barrel

4 A full list of serial numbers can be found in Goldsmith 1993 (see Bibliography).

THE VICKERS EXPOSED

Photos © Royal Armouries, XII.11139

1944 Lithgow-built .303 Vickers Mk I

1. Trigger
2. Safety catch
3. Tangent rear sight
4. Feed block
5. Filler plug
6. Water jacket
7. Barrel
8. Foresight
9. Muzzle cone
10. Drain plug
11. Tripod mounting
12. Elevating wheel
13. Elevating screw
14. Crank handle (cocking lever)
15. Crank
16. Fusee spring
17. Lock frame
18. Trunnion block
19. Rear cover catch
20. Rear cover

A Mk II Youlten's Patent Hyposcope fitted to a Vickers gun in use near Baghdad in 1917. The Hyposcope used a periscope mirror (not visible in the photograph), mounted above the trigger unit, that enabled relatively accurate aiming. It much reduced the possibility of the gunners being targeted by snipers and was, by the standards of the day, a relatively sophisticated device. (IWM Q 13450)

A very well-thought-out modification for anti-aircraft use. This Australian gun has had a lengthened tripod bracket made and a simple but effective drum to carry the belt, which tended to jam if the gun was being fired at a high angle. (Australian War Memorial E4843)

was introduced in early 1916 and as the old barrels and muzzle cups wore out they were scrapped.

The 250-round ammunition belts were made with distinctive brass reinforcing strips between each cartridge, the purpose of which is often misunderstood. The belt needed to be fairly rigid to feed properly through the gun, otherwise it would whip, twist and jam in the feed block, and the strips helped prevent this. Every third cartridge also had a projecting brass flange next to it, which performed two vital functions: firstly, showing to what depth the bullet should be seated in the belt (the tip should be parallel with the end of the flange); secondly, preventing the cartridges from slipping out of the belt during the frequently heavy-handed transportation that they endured. Loosened cartridges would jam against the edge of the feed block and cause a stoppage, or could simply fall out of the belt when in use. During the war many forms of stripless belts were tried and rejected and experiments continued through the 1920s. Eventually, after a huge amount of development work had been undertaken by a fabric manufacturer based in Manchester, Thomas French & Sons, a plain woven belt, the 'Belt, MG, .303 Mark II' (British Patent No. 358,424, 6 October 1931) was accepted into service; this was followed by the Mk III in 1936 and a final pattern, the 1942 Mk IV, which served all Vickers guns until their eventual withdrawal from service.

USE IN AEROPLANES, TANKS AND MOTORCYCLES

When adopted, the Vickers was supplied to the Army and Navy; at that time the Royal Air Force did not exist as a separate entity. The guns were initially issued to regimental machine-gun companies, but as the war continued it became clear that a dedicated machine-gun unit was required, so the Machine Gun Corps (MGC) was founded by Royal Warrant on 14 October 1915, with a training base at Belton Park in Lincolnshire; existing brigade machine-gun companies transferred to the new unit and infantry, motor and cavalry machine-gun units were eventually formed within the corps. This transformation was completed by early summer 1916 and as the need for Vickers guns increased, so too did the size of the MGC.

Of course, no one had the slightest inkling of the new forms of technology that would appear during the war to be used in situations that would have been utterly inconceivable even five years before. The first British aeroplane known to have been equipped with a Vickers gun was a Henry-Farman F22 'pusher', which had a standard Model 1906 gun fitted to a pintle mount in the front cockpit, but minus steam hose or water can, as the slipstream was believed to be sufficient to keep it cool. However, trying to find a more efficient method of mounting machine guns on aircraft posed many problems for the engineers. In the 'pusher' types, with a rear-mounted engine, the arc of fire was good, but ejected cases being whipped backwards could badly damage the propeller or engine.

The Vickers FB2 'Gun Bus' was the first Vickers-equipped aeroplane taken into British service in 1912, and despite its limited performance it provided sterling service. In aircraft with frontally mounted engines, fixed forward-mounted guns were the obvious solution, but achieving this without turning the propeller into matchwood was easier said than done. It was left to a Dutchman, Anthony Fokker, to come up with a solution in May 1915, when he demonstrated to the German air force an 'interrupter' system; this allowed a machine gun to fire through the propeller arc by

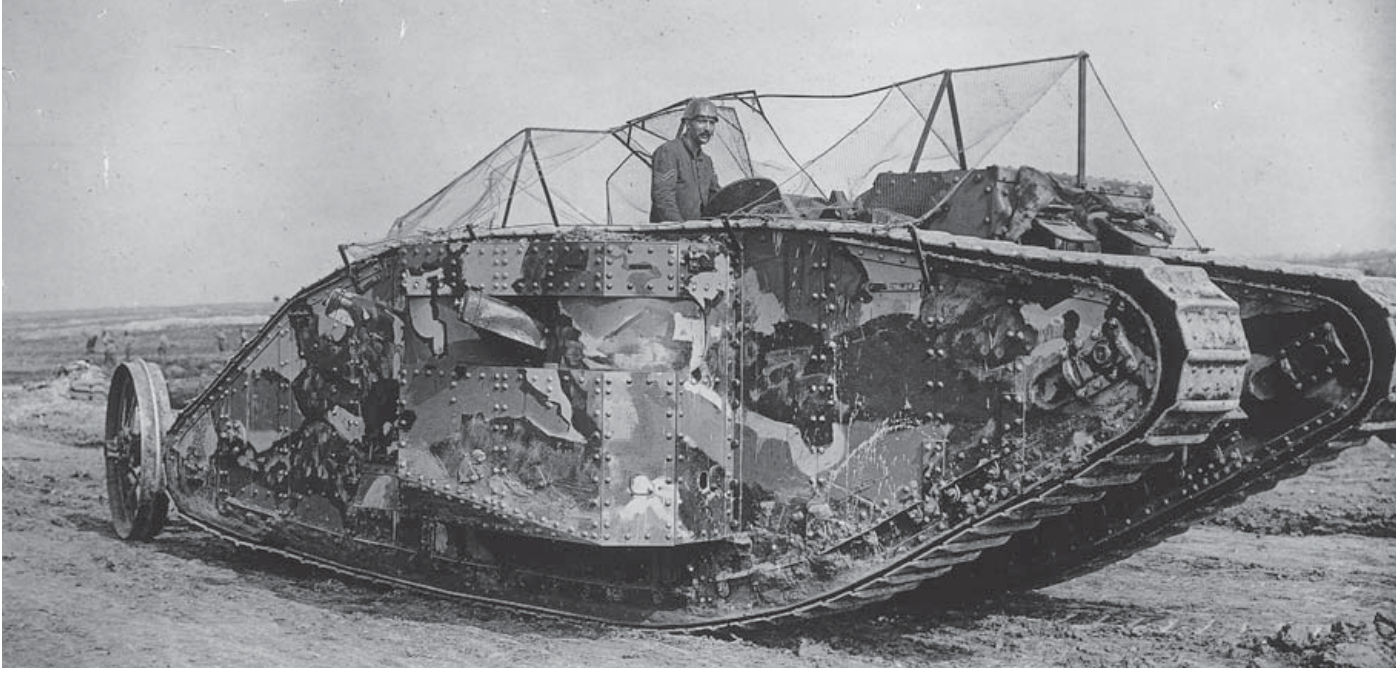
A Rolls-Royce armoured car at Abbeville in 1916. The use of these vehicles was very limited on the Western Front, but they provided sterling service in the Middle East. Like the weapon employed in the tank on page ?? [IWM Q 2488], this Vickers gun has been encased in an armoured jacket. (IWM Q 538)

means of a gear system, which stopped it shooting when the barrel was lined up with a blade of the propeller. This initial German advantage resulted in a desperate attempt by the Royal Flying Corps to find their own solution, and they went through a large number of experimental systems – Airco, Armstrong Whitworth, Constantinesco, Martinsyde, Ross, Scarff, Sopwith-Kauper and Vickers-Challenger – before settling on the best of the bunch, the Sopwith-Kauper.

This was not an interrupter system, but a 'synchronizer' that used a cam to activate the gun when it was safe to fire. All the pilot did by pulling the trigger was engage the gear system, which then operated only when it was safe to do so. Despite the occasional tendency for worn gears to allow the guns to run away and shoot the propeller off, it was the best by far, and was fitted to 2,750 aircraft. Jamming due to belt feed problems also proved to be a serious problem, the pilots having to fly their planes one handed while struggling to remove a stuck case. In addition the empty belt flapping wildly in the slipstream sometimes hit pilots or gunners so hard that it caused serious injury. Drum or box magazines were the answer, but were generally too bulky to fit inside the engine nacelle.

In early 1916 urgent experiments were begun to produce a reliable disintegrating metal-link system similar to that used by German aircraft. From October 1917 the Prideaux Mk III link system was adopted, some 72 million being manufactured; it was to remain almost unchanged in air service through World War II. The need for reliable feeding of the guns was heightened once it was realized that the normal rate of fire of a Vickers gun (500rpm) was simply too slow for fast-moving air combat – a rate of around 800–900rpm was required. The Hazleton Device, a simple muzzle restrictor and buffer system, was tested; this could provide a dizzying 1,000rpm, which was actually faster than the internal parts of the Vickers could reliably cope with, so it was modified to lower the rate

A cheery group of Motor Machine Gun Corps men astride their Clyno motorcycles on the Somme in late 1916. An MMGC battery comprised six guns and 26 motorcycles, with and without sidecars, plus three or four support vehicles. Many crews transferred to the Tank Corps but batteries continued to see service in the Middle East and on the Western Front, particularly throughout 1918. (IWM Q 6231)



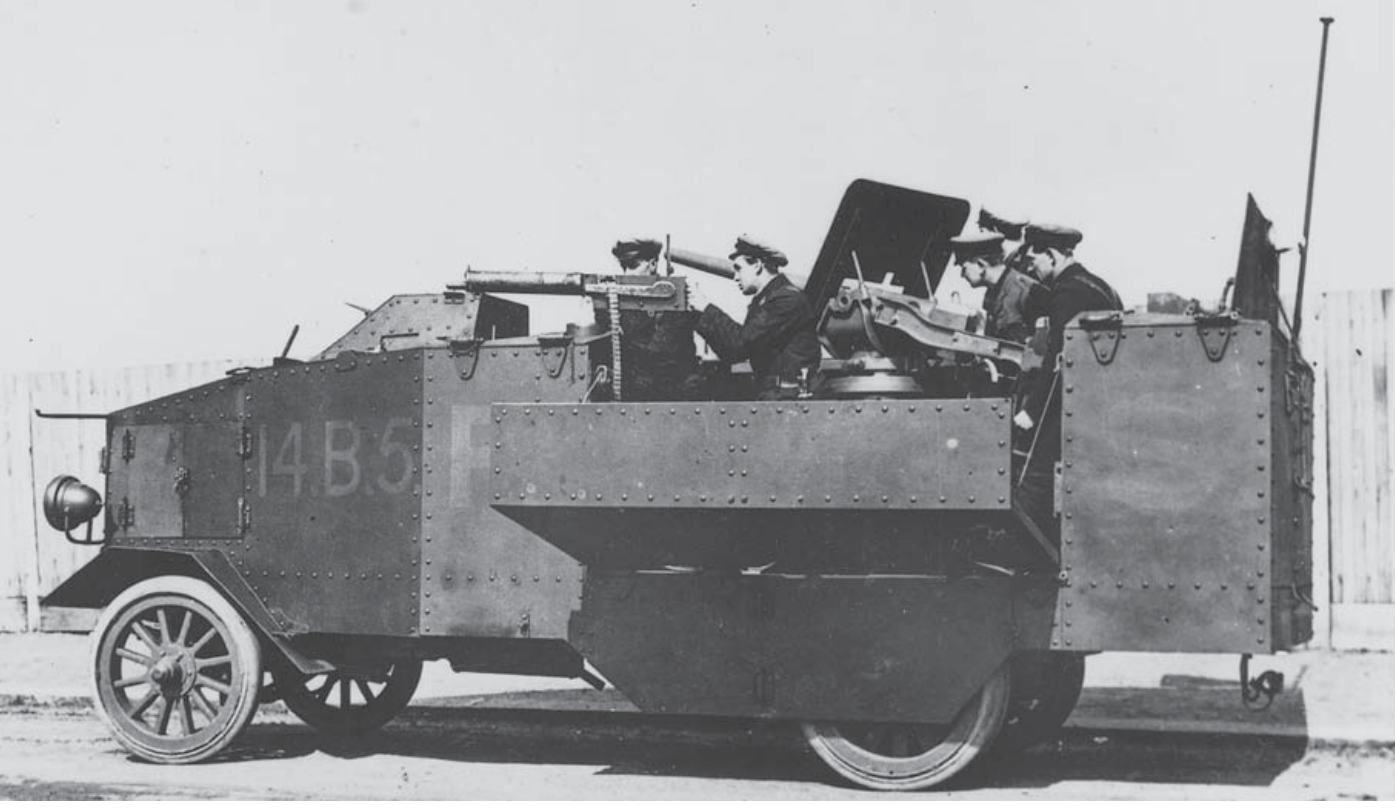
A Mk I 'Female' tank in September 1916. These early models had two large sponsons each containing a pair of Vickers guns covered by their armoured jackets, which can be seen clearly. The ball mounting made it impossible to fit condenser hoses, so considerable quantities of water had to be carried. The guns proved too vulnerable and were later withdrawn from tank service. (IWM Q 2488)

and then widely adopted. As a result the additional wear on the working parts meant that side-plates, fusee springs and springs had to be strengthened and a larger cocking handle fitted. The guns had no water cooling, so the front of the jacket was machined with large vent-holes in it, and rear 'gills' to allow the passing air to exit. On fighters such as the Sopwith Camel that mounted two guns, a new left-handed feed block was produced, permitting ammunition feed from either side. These modifications were to provide British pilots with a considerable advantage over their German counterparts, whose guns generally remained unmodified with a ground-use rate of fire.

The air war was not the only new form of combat that was to make demands on the Vickers gun; a picturesque if somewhat impractical motorcycle and sidecar outfit was equipped with them. This was devised in late 1914 as a speedy method of moving machine guns from one sector to another, or pursuing fleeing German units across country. Vickers procured 120 744cc 5/6hp V-twin motorcycles from Clyno of Thrapston, Northamptonshire, at £160 each (a not inconsiderable £12,000 or US$19,500 apiece today), each with sidecar fitted and fully equipped with Vickers gun, tripod, seven boxes of ammunition, three tins of water, two of oil, two barrels and a spares kit.[5] The units raised, comprising the Motor Machine Gun Corps (MMGC), were never, in practice, used in the manner that they were trained for, as the stagnant realities of trench warfare meant that most motorized outfits remained in reserve areas; the majority of their crews were eventually transferred to serve in the tanks, when they were introduced as the Heavy Section Machine Gun Corps (HSMGC) in March 1916 (becoming the Heavy Branch Machine Gun Corps in November 1916 and the Tank Corps in July 1917).

Initially the new Tank Corps required several dozen modified Vickers guns as the primary armament for the 'Female' tanks, which comprised

5 I am grateful to Mr H. Johnson of the Vintage Motorcycle Club for this information.

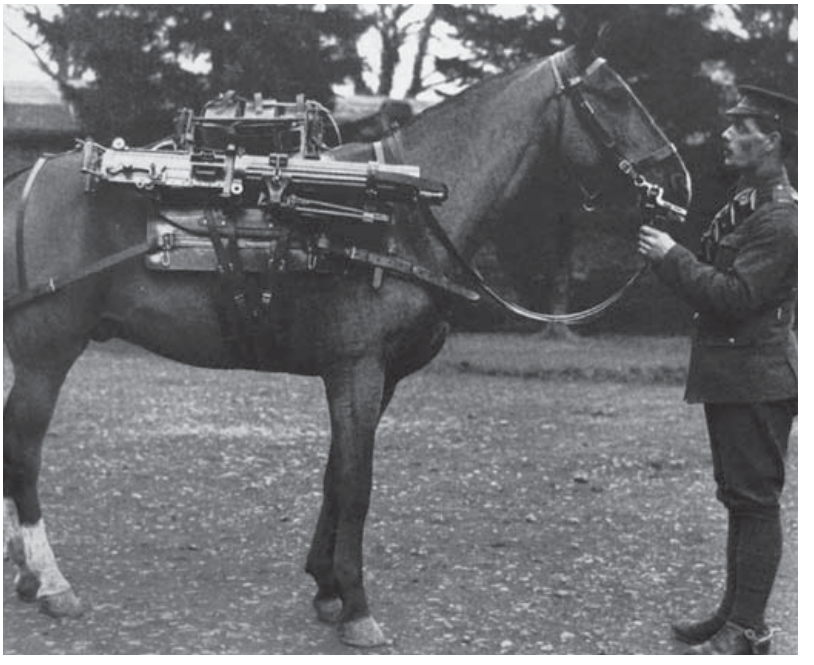


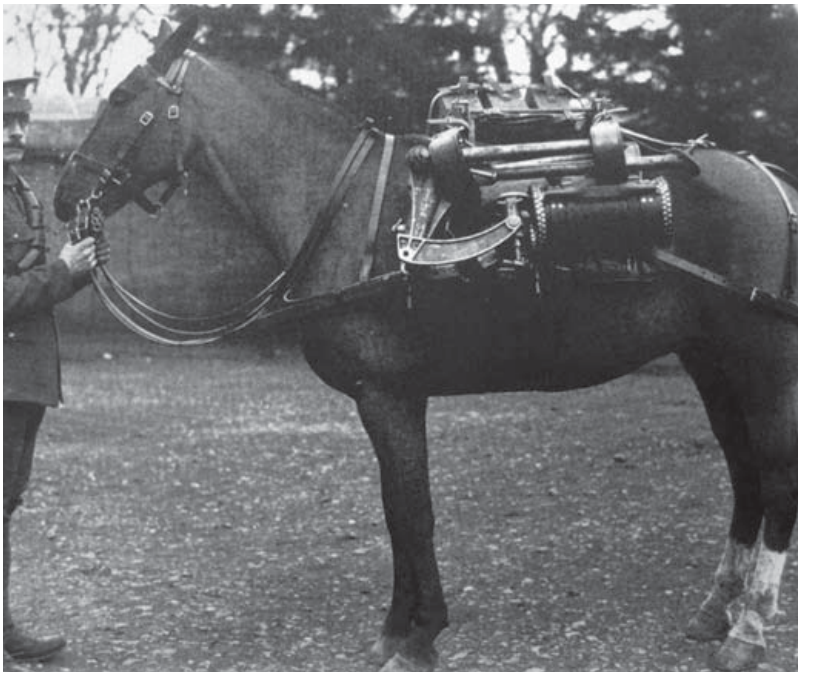
A Royal Naval Air Service Seabrook lorry with a Model 1893 Maxim gun and Hotchkiss QF 6-pdr, photographed in 1914. It is not dissimilar in appearance to the armoured trains used during the 2nd Anglo-Boer War. (IWM Q 14533)

four Vickers guns mounted in ports in left- and right-side sponsons, while the 'Male' tanks – in addition to a pair of Hotchkiss Quick-Firing 6-pdr guns – had two Vickers. Unfortunately, one of the most vulnerable parts of the gun's design was its water-jacket, for once punctured the cooling water rapidly drained away – as well as letting off a tell-tale plume of scalding steam. There was little doubt that tanks would be subjected to intense small-arms fire, so an armoured jacket cover (similar to that fitted to the MG 08) was produced to protect the water-jacket. In reality, the guns were quite unsuited to tank use, being heavy to traverse with their armour and impossible to use with water hoses. Water cans had to be kept inside the tanks, already overcrowded with men, ammunition and spares. Worst of all was the ease with which a bullet could penetrate the armoured jacket and enter the tank – and often the gunner – through the receiver of the gun. After an equally disastrous period during which the Vickers was replaced by the Lewis gun, the more practical Hotchkiss was issued and remained the standard for the rest of the war. Despite this, when the Mk I tanks of the HSMGC first rumbled into action on 15 September 1916, they were carrying Vickers guns.

So, too, did the Royal Naval Air Service's armoured-car squadrons, formed in 1914, whose Rolls-Royce and Mercedes cars mounted one or two Vickers guns in a turret. They could not fight in the prevailing conditions on the Western Front but proved particularly useful in the Middle East, where the drier conditions suited their rather delicate mechanics. In the summer of 1915 control of these units passed to the MMGC and ultimately the HSMGC.

Horsepower was also used in its original context for the Vickers, as the vast majority of transport and movement over the battlefields was





A mule or horse pack for the Vickers. This was a typical World War I carrying system and enabled guns and accessories to be brought up almost to the front lines, in conditions that defeated mechanized transport. (Royal Armouries)

provided by horses and mules. To facilitate carrying the Vickers, a special harness was devised at the outset of the war to carry a complete Vickers gun and its ancillaries; this frequently proved to be the only practical method of getting the weapons anywhere near to the front line. A similar carrying device was created for use on camels, for the Vickers was used in great numbers in desert conditions, although in practice this seldom proved practical, as camels were far more temperamental than mules.

A Carden-Loyd Mk VIB Machine Gun Carrier of the late 1930s. It was eventually modified to become the Universal Carrier, but was generally known as the Bren Gun Carrier, a misnomer as the design was predominantly to enable the Vickers to be moved quickly over the battlefield. (Tank Museum, Bovington)

THE INTER-WAR YEARS

By the time the armistice was agreed, there had been over 75,000 Vickers guns manufactured for use by all branches of the British and Commonwealth armed forces. When peace was finally declared, war production ceased almost overnight. One disabled war veteran, by then working for Martinsyde, a Vickers subcontractor, recalled that: 'When I went to work on the Monday after the armistice, there was a notice on the gate telling us to collect our cards from the office as the company had no further need of us. That was it, we weren't needed anymore and were just more war scrap' (Jarman n.d.).

All remaining guns were returned to Vickers, stripped and inspected, and damaged or badly worn ones were condemned. The number left is not accurately known but was probably less than 15,000. They were re-assembled with new parts, greased and placed in storage. Despite the stringent Army budget cuts, some work continued on weapons development, particularly in the light of experience gained during the war, and a number of small tracked vehicles or 'carriers' were developed, most notably the Carden-Loyd and Universal carriers. The Universal model

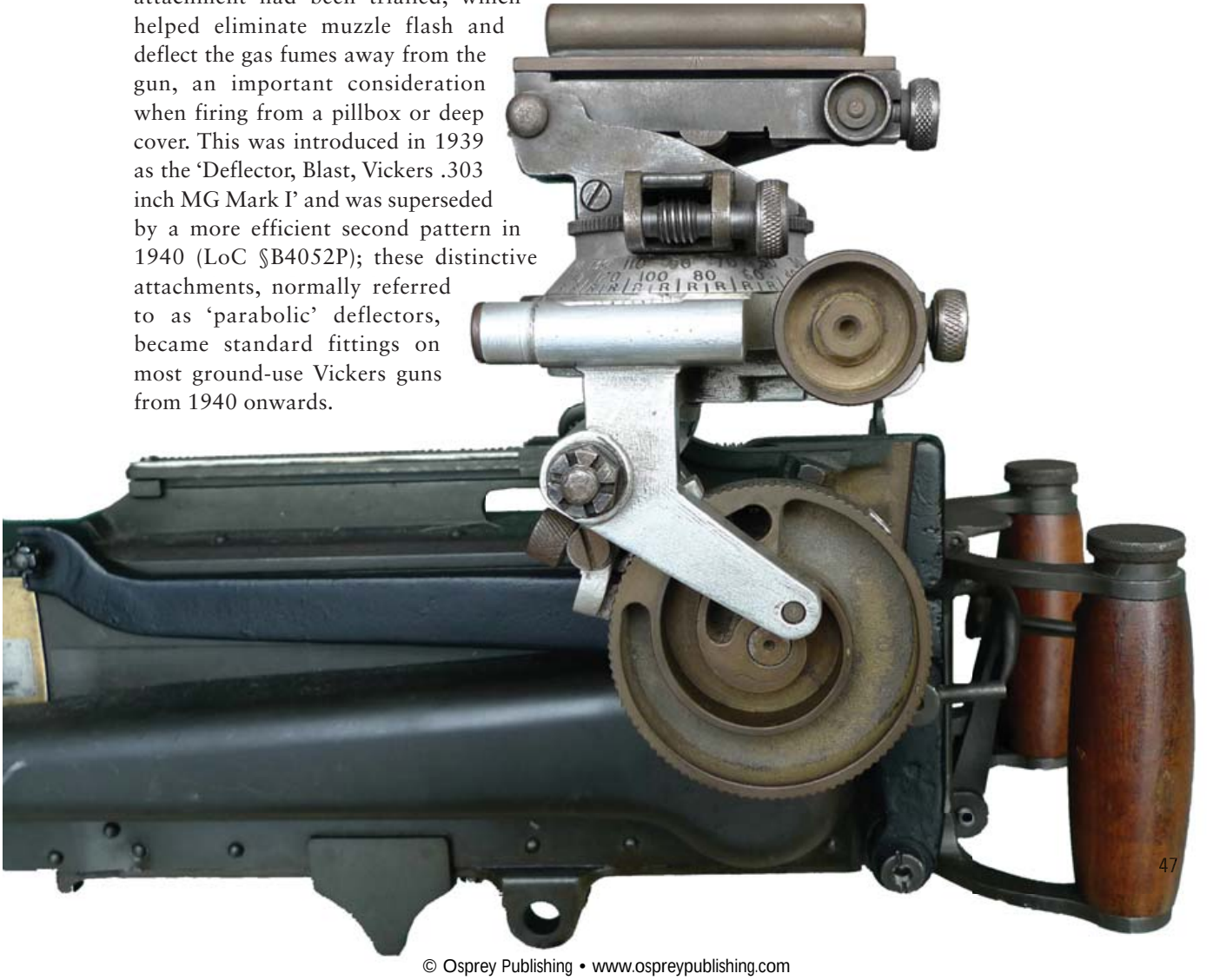
Ammunition improvements

The Vickers had been designed to function with all marks of .303in ammunition, but the standard pattern during World War I had been the Mk VII, with its 174-grain copper- or cupronickel-jacketed bullet and 40-grain cordite charge. This was gradually supplanted by the Mk VIIz with nitrocellulose charge, producing a muzzle velocity of 2,440ft/sec. Late in 1917 specially selected ammunition was manufactured for aircraft use that was made to far higher quality standards; this was known as 'Red Label' due to the colour of the boxes in which it was issued. Several patterns of ammunition for air use were subsequently produced; probably the most significant change was the introduction in 1939 of the Mk VIIIz cartridge, which had a 175-grain boat-tailed (streamlined) bullet. In fact, this cartridge was an attempt to standardize all .303in ammunition to the higher Air Service specifications, and it provided the Vickers gun with an additional 900yd of range, maximum range becoming 4,500yd. It was not, however, recommended for Service rifles because of the higher pressures it generated. The Mk 8z, as it subsequently became, was to remain the standard ammunition for the Vickers until it was withdrawn from service.

became known as the 'Bren Gun carrier', which despite its name was actually designed to mount a Vickers gun in the open crew compartment. The evolving design of armoured vehicles called for a more powerful machine gun, so in 1933 the 'Gun, Machine, Vickers .5" Mark I' was introduced. This was basically a scaled-up .303in gun weighing 63lb that chambered the special Vickers .5in cartridge (slightly shorter than the Browning .50-calibre cartridge); the model was finalized as the Mk V in 1935 (LoC §A9693), with 1,117 guns being manufactured for armoured and naval anti-aircraft use.

While manufacture of ships once more became the mainstay of the Vickers-Armstrong Company (as it was now known) during the inter-war years, a slow trickle of machine guns and spare parts emerged from them – but the bulk of spares and accessories required were manufactured by the Royal Small Arms Factory at Enfield. It is a tribute to the design of the 1912 Model that there were no real changes needed in the design. The most noticeable difference was that virtually all guns made from 1919 were fitted with the smooth water-jacket, which was easier to make, but increased the weight by about 2lb. In late 1918 a new muzzle attachment had been trialled, which helped eliminate muzzle flash and deflect the gas fumes away from the gun, an important consideration when firing from a pillbox or deep cover. This was introduced in 1939 as the 'Deflector, Blast, Vickers .303 inch MG Mark I' and was superseded by a more efficient second pattern in 1940 (LoC §B4052P); these distinctive attachments, normally referred to as 'parabolic' deflectors, became standard fittings on most ground-use Vickers guns from 1940 onwards.

The Mk II dial sight is complex and comprises (from the top): the lensatic optical sight and its carrier that provided both vertical and horizontal adjustment; the worm adjuster, a small brass drum, which provided lateral or deflection adjustment; and the range drum, the large brass wheel next to the receiver. (Author)



An inspector at Enfield examines refurbished guns early in World War II. The depleted stocks of World War I weapons had to be overhauled and accessories supplied. (Royal Armouries)

As the 1930s rolled by, the stock of serviceable guns dwindled as many were converted for tank use or instructional Drill Purpose guns, and considerable quantities were sent to Imperial outposts such as India. The Crayford factory had been closed in early 1931, so the sole production facility was now Erith, but as the threat of another war with Germany loomed large, it was believed by the War Office that the number of guns held in stock should be increased. As a result old guns were refurbished and production was begun.

INTO WORLD WAR II

Throughout World War II 11,828 new guns were manufactured, with 'V' and 'W' prefixes – along with 64,183 barrels, 13,207 locks and 19,205 tripods. Britain was not the only manufacturing base, however, for there were insufficient guns to enable the Australian armed forces to be supplied

and in 1925 a plant had been established at Lithgow in New South Wales to manufacture the Mk I Vickers. Up to 1945 some 12,344 guns were produced there, with tripods and accessories (Skennerton 1998: 6).

While all these World War II guns were identical in form and function to those of the previous war, there was one important accessory that became a standard fitment from 1939 onwards – the dial sight. During World War I a rangefinder was used to estimate range as well as a fire director and clinometer, all being similar in type to those used by the artillery, and these were employed to calculate angles of elevation and fire direction. In April 1939, the 'Sight, Dial, MG Mark I' (LoC §B3158) was introduced. It was a complex piece of equipment, requiring 74 parts, and comprised a 'lensatic' optical sight and internal spirit level as well as incorporating range, angle of sight and deflection drums; it replaced the earlier methods of range and elevation assessment, although clinometers (for checking correct elevation) continued to be manufactured and used. Mk II and Mk III clinometers were produced during World War II.

The Vickers gun continued to be heavily engaged during World War II, although the weapon's employment was by then in the hands of five specialist infantry regiments deploying machine-gun battalions, rather than a dedicated corps. (The MGC had been disbanded in 1922.) These units provided sterling service and at times employed their weapons in sustained-fire roles reminiscent of those played during World War I, with many individual guns firing tens of thousands of rounds at a time. It is perhaps worth noting that the last newly manufactured Vickers gun was taken into service on 1 June 1945.

THE END OF THE LINE

When World War II ended, the Vickers guns had barely been returned to store before they were yet again required for use in Malaya, Africa, Borneo, the Middle East and of course Korea. There was one final attempt at updating the old weapons, however, when in 1950 the Canadian Ordnance Section converted some Vickers guns to fire the new .280in cartridge, widely tipped to become the replacement Service round for NATO. It had considerable potential:

> The gun speed [520–600rds/min] is high [and] it shows that there is plenty of power available to operate the weapon with the .280 cartridge. The .280 Vickers MG as modified by Canada and this Section has proved promising but it will be necessary for an Endurance Trial to be fired before the conversion can be considered to be satisfactory. (Quoted in Goldsmith 1994: 185)

Alas, there never was any trial, for by then the Vickers was too costly to manufacture, too cumbersome on the battlefield and too tactically limited. It was phased out of service in 1962, to be replaced by the lighter and simpler Belgian-designed 7.62mm MAG 58, known in British service as the General Purpose Machine Gun.

USE

Machine gun of empire and world war

The last two decades of the 19th century were busy ones for the British Army, policing Britain's busy colonial interests that left the Army's units spread thinly across the globe. In 1882 Britain invaded Egypt and in 1885 it sent an expeditionary force into Burma, and late in the 1890s more fighting broke out in sub-Saharan Africa.

It is a little-known fact that the Maxim gun first saw action, not in the much-publicized 1st Matabele War, but in Mombasa in 1887 when a single gun, taken by Henry Morton Stanley (1841–1904), was the first to be recorded as having been used in combat. It was acquired (no one has determined exactly how) by an English soldier-adventurer called Frederick Lugard (1858–1945; 1st Baron Lugard), who used it and one other in January 1892 in a religious war fought between Protestant and Catholic forces in Uganda, where Lugard had sided with the Protestant cause. Despite the fact that the guns jammed constantly, they proved decisive, one French missionary later writing:

> All of a sudden I saw bullets begin to rain on the royal hut, making a terrible noise in the copse that surrounded us; it was the Maxim mitrailleuse, which joined its fire to that of boats loaded with soldiers. Just a few canoes, and a crowd of 3,000 or 4,000 throwing themselves in the water [to escape the bullets]; it was heart-breaking. What shrieks, what a fusillade! What deaths from drowning. (Quoted in Ford 1996: 49)

Historic as this was, it was of course a side-show compared to other events in Africa, for there had been uncomfortable rumblings in South Africa for years and the situation had not been helped by the British desire to consolidate the rich gold- and diamond-bearing area of what

was then Southern Rhodesia (now Zimbabwe) in a region known as Matabeleland. In their usual way, the British assumed that any society touched by the forces of Her Imperial Majesty would prove to be grateful and any signs that it was not were swiftly dealt with. The Ndebele tribe (called Matabele by the British) were united under King Lobengula (1845–94) and were related to the Zulu. They comprised over 10,000 tough warriors, who were well disciplined and utterly loyal to the king.

Initial approaches by Cecil Rhodes to obtain mineral rights in the south-west of the country led to the formation of the Chartered British South Africa Company – comprising 200 volunteers and a 500-man 'Charter Company' of soldiers, tactfully referred to as 'police' – which was reluctantly accepted by Lobengula. However, he quickly realized that this was merely a precursor to colonization and he mobilized his not inconsiderable army. The British military position was unusual, for there was no Regular Army presence as such, with the exception of the commanding officer – Lieutenant-Colonel E.G. Pennefeather, 6th Dragoon Guards.

The British were desperate to find an excuse to begin military action against King Lobengula and they found one in July 1893 after a cattle-rustling raid by the Matabele's traditional enemy, the Shona, whom the king punished by massacring some 400 villagers. This was a purely local affair and no business of the colonists, but it provided a perfect reason to tighten the British grip on Matabeleland and a force of 700 volunteers led by their guides, Dr L.S. Jameson and Frederick Selous, headed towards the region, where they met with another similar-sized force that had marched from Salisbury (now Harare). They were well armed, with Lee-Metford bolt-action magazine rifles, four 7-pdr field guns and, crucially, four Maxims, one Nordenfelt and one Gardner. They found the king's army of 4,000–5,000 men on the banks of the Shangani River on 24 October 1893.

Unlike many native tribes, the Matabele were very wary of the dangers inherent in attacking troops in broad daylight who were armed with modern rifles. They had no qualms about night fighting, however, and they launched a mass assault on the colonists' line in the early hours of the morning, but one factor they could not possibly have predicted was the firepower of the Maxim guns. The result was bloody, predictable and redolent of the carnage of a later war in Europe. On 3 November 1893 the *London Daily News* reported the battle:

> Most of the Matabele had probably never seen a machine gun in their lives, and had but a dim idea of the effects of concentrated rifle fire. Their trust was in their spears for in all their rude experience of warfare they had never known an enemy to withstand them. Even when they found their mistake, they had the heroism to regard it as only a momentary error in their calculations. They retired in perfect order, and reformed for a second rush. Once more the Maxims swept them down in the dense masses of their concentration and once more they retired. It seems incredible that they should have mustered for still

> another attack, yet this actually happened. They came as men foredoomed to failure, and those that were left of them went back a mere rabble rout.

Hiram Maxim subsequently received a flood of congratulatory letters, the most graphic from one of the Charter policemen, R.C. Batley, who wrote:

> [They] never got nearer than 100 yards – led by the Nubuzu Regiment, the king's bodyguard, who came on, yelling like fiends and rushing on to certain death, for the Maxims exceeded all expectations and mowed them down literally like grass. I never saw anything like these Maxim guns, nor dreamed that such things could be; for the belts of cartridges were run through them [150 in each belt] as fast as a man could load and fire. Every man in the Laager owes his life under Providence to the Maxim guns. (Quoted in Goldsmith 1989: 108)

The one brief Matabele account of the battle that has been preserved was more succinct: 'The white man came again with his guns that spat bullets as the heavens sometimes spit hail, and who were the naked Matabele to stand up against these guns?' (quoted in Ranger 1967: 52). This first use of the Maxim was followed only a week later by a second abortive assault and this sealed the fate of the Matabele and of Lobengula himself, who is believed to have subsequently committed suicide.

It was clear for all to see that machine guns were fast proving a very decisive weapon in the hands of whoever possessed them and the British wasted little time in increasing the numbers they had. The Indian Army was particularly keen to obtain Maxim guns and had managed to buy about 50 .45in Maxims by 1895 and a further six .303in Model 1893 guns shortly afterwards. This was fortunate, for within weeks they were used during the Chitral campaign, on 3 April 1895. On 11 May 1895, the *Illustrated London News* reported:

> The Malakand Pass was successfully stormed by the Gordon Highlanders, the Guides, the Scottish Borderers and some companies of the 4th Sikh Infantry. The British loss was three men killed and about fifty injured. The enemy's loss was estimated to be nearly five hundred killed. The Maxim guns ... for some hours ... did deadly work against the indomitable natives.

Tactics for using the guns were evolving slowly, from the simple crossfire used during the 1st Matabele War to a more sophisticated use in Chitral, as reported in the *London Gazette* on 14 June 1895: 'Several attempts were made by the enemy to concentrate fire from above and hold sangars and positions, but all such attempts were frustrated by the admirable practice of the ... Maxim guns firing over the heads of our advancing infantry.' Although the heavy guns were difficult to carry, special pack saddles were devised to enable a mule to carry a gun and tripod, with others taking the ammunition and spares; in poor terrain these proved an admirable solution.

MAXIMS IN THE SUDAN

Meanwhile, problems continued to beset the British Army in the Sudan and in 1896 a process of reconquest was begun under Major-General Horatio Herbert Kitchener (1850–1916). The region had been a constant thorn in the side of the British Government and a combined British and Egyptian force of some 14,000 soldiers faced a Mahdist force of roughly equivalent numbers at Atbara on 8 April 1898. This time the four Maxims, one Gardner and one Nordenfelt from the Machine Gun Sections of the 1st North Staffordshire and the 1st Connaught Rangers were brought into action.

Because of the sudden ferocity of the local dust storm, the *haboub*, all firearms had to be kept oil free and the guns were covered in silk cloth, then hastily stripped and oiled prior to action. The sections carried 5,000 cartridges per gun and at Atbara the weapons were used at their extreme range, opening fire from the flanks at 1,800yd. In view of the lack of rangefinders, the officers in charge of the detachments used binoculars to work out the range:

> … the sights of the gun were hardly ever used to aim by. An officer would estimate the approximate range, and open fire a couple of hundred yards short of it. Then he would work quickly up to his target, exactly as if he held a garden hose, and guided by the dust which flew up as the stream of bullets hit the ground. When he arrived at the bobbing white figures, the lateral movement would begin. (Quoted in Goldsmith 1989: 107)

For a total of 83 British and Egyptians killed and 400 wounded, the Dervish losses were estimated to have been 3,000, mostly at ranges that prevented their returning accurate fire. This however, was merely a prelude compared to the next clash between the two armies seven months later, at Omdurman on 2 September 1898. This time there were six Maxims from the 1st Brigade and four from the 2nd, and they were certainly needed, for the Dervish army under the Khalifa Abdullah, who had been appointed the mahdi's successor. He fielded an estimated 50,000 men, compared to the 23,000 of the combined British and Egyptian force.

Unlike their comrades at Atbara, the Dervish army at Omdurman moved forwards using the dead ground between the *knors*, small hills that dotted the landscape; they were able to approach to 800yd before

Matabele Wars, October 1893 (overleaf)

The use of the Maxim by the British South Africa Company Police during the Matabele campaign showed just what potential the machine gun had. Although tactics at the time were in their infancy and mostly limited to the guns firing to their immediate front, the sheer volume of fire proved utterly decisive and the few Matabele who did escape the bullets were soon dealt with by the Lee-Enfield rifles of the police. However, the size and weight of these carriage-mounted guns made them particularly vulnerable during such operations and this was to prove a constant shortcoming with the design.

A rare 2nd Anglo-Boer War picture, showing a group of British soldiers, seated behind a captured air-cooled 'Extra Light' rifle-calibre Maxim. It weighed a mere 27lb, but had a tendency to overheat during sustained fire. (Author's collection)

being spotted, many more crawling forwards until they were within a couple of hundred yards of the British lines. The Maxims opened up as soon as the advance soldiers of the Khalifa's army were spotted, for the bulk of the enemy were still out of range of the Martini rifles of the infantry – and the speed with which the Dervish army advanced would have made it possible for it to overrun the smaller force by sheer weight of numbers. But the Maxims took care of that:

> The Dervishes seemed to rise out of the ground ... for a moment it seemed that the Dervish hosts might overwhelm our forces. In dense array the Dervishes moved to consume their feast of flesh: but their ranks were torn by the murderous machine gun fire. Major von Tiedemann, the German military attaché, rode out to the right flank to observe the effects of the Maxim battery. So soon as the machine gunners found the range the enemy fell in heaps, and it was evident that to the Maxims went a large measure of credit in repelling the Dervish onslaught. (Quoted in Goldsmith 1989: 106)

So feared were the machine guns that during the later stages of the battle another Dervish force tried desperately to surround and capture the Maxim-gun position on its low mound; the British commander, Colonel Reginald Wingate, managed to repulse the last of the tribesmen when they were only 94 paces (roughly 78yd) from the muzzles of the guns.

Omdurman and its associated colonial-era battles were surely the clearest possible signal to the world that it had witnessed the end of the traditional forms of warfare, where frontal attacks relying on raw courage and numerical superiority would carry the day. Up to the end of the 19th century, the British Army more or less had an open field when it came to the use of superior technology on the battlefield. Its artillery, small arms and the new machine guns demonstrated that, beyond doubt the British were an unopposable force when faced by poorly armed colonial armies. (Oddly, after Omdurman several Nordenfelts and Gardners were found in the Khalifa's armoury. Why these were not employed remains a mystery.)

THE 2nd ANGLO-BOER WAR

However, the game was to change dramatically in the Transvaal in the final decade of the 19th century. For the first time since Waterloo, Her Majesty's Army was to face an enemy that was as well armed as it was – and better suited to the local terrain. In the 1880s the Boers had risen in revolt over British rule in the Transvaal, threatening Britain's dominant position over the lucrative South African trading market. The Boers had bought the latest

small arms; this included at least 24 Vickers-Maxims and several Maxim 1-pdr 'pom-pom' guns, with which they were expert. Although pitched battles between Boer and British troops were rare, when Boer machine guns were encountered, the end result was seldom a good one for the British Army:

> … it was found that [the Boers] concealed in the bush and using smokeless powder were able to put a whole battery of English field guns out of action in about ten minutes. As a rule they succeeded in killing all the men and horses before the English could find the range or ascertain from what quarter the explosive projectiles were coming from. (Seton-Hutchinson 2004: 74)

TOP Troopers of The Northumberland Hussars with a pair of privately purchased Model 1893 Maxims. (Author's collection)

ABOVE British machine-gunners with a Model 1983 British Service Maxim during the 2nd Anglo-Boer War, firing from behind a *sangar*, the Hindi word for stone, usually referring to small protective stone firing positions. The gun has its Mk II tripod, which was some 30lb lighter than the original model. (Author's collection)

The British Regular and Volunteer detachments used Maxims as well, but seldom to such good effect, as the fleet-footed Boers rarely stayed still long enough to present a decent target; when Imperial troops attacked well-defended Boer lines at Magersfontein on 11 December 1899 they lost 1,000 men to the Boer guns.

Unsurprisingly, after the 2nd Anglo-Boer War there was a good deal of critique in respect of the guns and their tactical worth and a report later submitted by Lieutenant-Colonel Alexander Thorneycroft, who commanded a Mounted Infantry unit, makes interesting reading. His criticisms were remarkably few and he was mostly concerned with the difficulties of long-range shooting and preserving the reliability of the guns in conditions where they were not properly maintained. However, his comments on their tactical use and the associated psychology of facing machine guns were particularly apposite:

> The moral effect produced on the enemy by machine gun fire has been great. I have frequently used it to support the advance of my scouts … on one occasion, [they] entirely cleared the camp of German commando, and on all occasions has given valuable assistance in keeping down the enemy's fire, especially their long-range sniping. I would strongly advocate the greater use of machine guns … in the scouting lines. To obtain the best from these guns they should be pushed forwards with great boldness, even at times risking the loss of the gun. These guns should be used singly, when they are more easily concealed, more quickly brought into action, and more quickly withdrawn. (Quoted in Goldsmith 1989: 110–11)

Shooting the Vickers

The author has been fortunate to be able to fire thousands of rounds through Vickers and Maxim guns, so it may be of some interest to readers to understand what these guns are like to set up and shoot. Setting up is not difficult; if a new barrel is selected, the asbestos packing must be oiled and wrapped into the machined grooves at breech and muzzle. As the barrel expands this string acts as a water seal preventing coolant leakage, although a certain amount of water and steam does inevitably escape. Every gun tends to fire at a different rate, so the fusee spring is set at between 7lb and 9lb pull, but this must be adjusted during firing. If the gun is shot non-stop, usually the rate of fire speeds up, the fusee spring having to be loosened off slightly to compensate for the generated heat from the working parts altering its tension. Setting up headspacing with the correct tool is quite easy and if a spare breech block is readied at the same time, then in the very unlikely event of a broken spring or firing pin, swapping over is the matter of about 30 seconds' work.

A Vickers water-jacket holds 7 pints of water, which boils after 600 rounds have been fired at a rate of 200rpm. It then consumes 1½ pints of water every 500 rounds and after one hour's firing (10,000–12,000 rounds) at a steady 200rpm the barrel requires replacing.

To do this, the gun is tilted muzzle-downwards, the upper retaining screw on the spade grips is removed and the grips are swung downwards. The fusee spring is unhooked and the muzzle attachment unscrewed. When the cocking handle is pulled sharply rearwards it brings the side-plates and barrel backwards out of the receiver as one unit. At this point, the No. 2 of the gun pushes a cork into the muzzle aperture to prevent water loss and the barrel is replaced. (If the No. 2 wasn't wearing gloves before, he will be now, as the barrels and water-jacket are red-hot.) The reversal of this procedure puts the gun into working condition again and usually some topping-up of the water is required. A good gun team could do this in around two minutes.

Sliding the tab of the belt into the feed block, the No. 1 gives it a sharp pull from the left to seat the first cartridge properly, then gives two pulls of the cocking handle, initially to extract the first round, then to chamber it, with a second round ready for extraction. While the second finger on each hand is used to lift the safety bar, the spade trigger (which has a deceptively long travel) is depressed by the thumbs and the first round fires. Initially the gun jerks sharply, then settles down with a steady rocking motion and a distinctive 'rat-tat, rat-tat tat tat'. A Maxim, with its slower rate of fire, made a more measured 'tac-tac-tac' sound, and World War I infantrymen could tell instantly whether the gun firing was British or German.

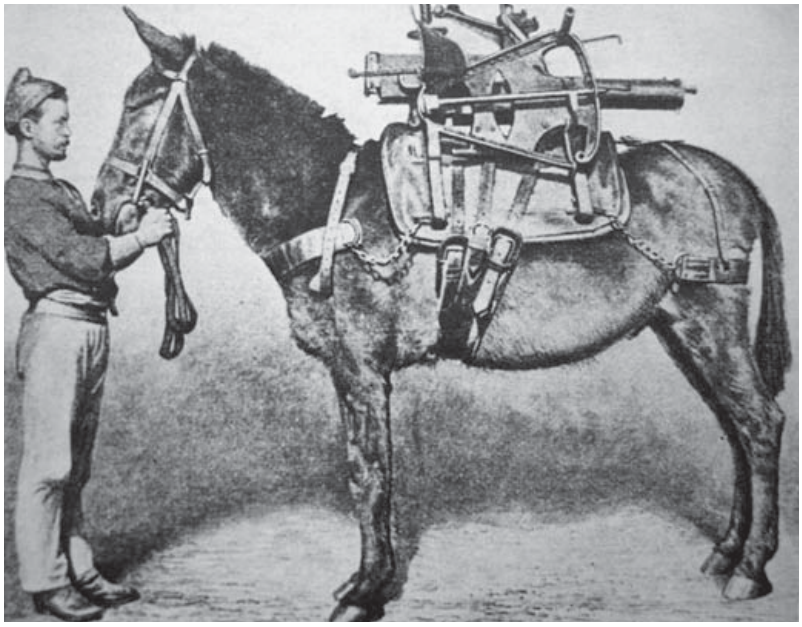
Skilled machine-gunners could fire single shots and all learned to tap the traversing handle with the heel of the hand to deflect the line of fire left or right, each tap representing 15 degrees of arc, a skill the author has never quite managed to achieve. A swinging traverse is much easier to master and should move the line of sight 1yd every 2 seconds. Once settled into a rhythm, the Vickers is very stable and actually extremely easy to fire, requiring the gunner merely to hold the grips (but not too firmly) and observe the bullet strikes.

As the barrel heats up, steam escapes from the muzzle gland; this was often a dangerous give-away of the position of a hidden gun. With the tripod weighted down by sandbags and firing in short bursts it is possible to put 20 rounds through the black of a target at 200yd with each burst. Bearing in mind this is not a sniping rifle, but a fully automatic weapon, this is more than tolerably good accuracy.

Jams are generally due to loose cartridges snagging as they reach the feed block or occasionally falling from worn belts (most are now over 50 years old) but cause only a few seconds' disruption once cleared and the weapon is re-cocked. Experienced gunners could tell instantly from the position of the cocking handle what sort of stoppage had occurred.

Bursts of around 20 rounds are ideal, enabling the barrel to keep cool and the gunner to observe target hits, but firing a 250-round belt in one go and watching targets crumple and disintegrate leaves one wondering how any human being was able to advance against such firepower and stay alive. Multiply this fire by several times to allow for a section of guns shooting and the reason for the appalling casualty levels of World War I becomes horribly clear. It is little wonder that while the artillery was deemed king of the battlefield, the machine gun soon became the queen.

ABOVE An idea of the range at which a Vickers was capable of firing can be gained from this photograph. An Australian gun crew on a Korean hillside watch over an endless expanse of fields. Although ranges are hard to judge from a photograph, the gun could certainly fire into the hills in the middle distance, and probably, at extreme elevation, onto the plateau beyond. (IWM BF 423)



A mule pack devised for the Model 1893 Maxim gun and its heavy Mk I tripod. There were many pack variants used, as horses and mules were employed in huge numbers right through to the end of World War II. (Author's collection)

In other words, heavy mounted carriages, ammunition limbers and horses hindered the tactical use of the machine guns. Thorneycroft's suggestions were eventually adopted, but not until the latter stages of the greatest conflict the world had ever seen.

LESSONS FROM THE RUSSO-JAPANESE WAR

There had been considerable use of Maxims during the brief Russo-Japanese War (1904–05), and European observers noted with interest the Russian use of machine-gun detachments comprised of specially trained units, attached to infantry regiments. Additionally, they had dispensed with their heavy wheeled limbers and used pack-mounted guns to provide greater mobility, placing them where and when needed, rather than in artillery-like batteries. Japanese attacks were often utterly defeated solely by machine-gun fire, possibly the best example being the attack on Port Arthur (19–24 August 1904), where 38 Russian Maxims were placed on the bastions of the fort to defend the open approaches of the hill: 'They [the Japanese] gained the parapets of the rampart and swarmed over it. Into this seething mass of humanity the machine guns of the fort poured such a tremendous fire that the attackers were mowed down, crushed, dispersed ... in less than a minute' (quoted in Seton-Hutchinson 2004: 89).

Constant further attacks by the Japanese resulted in the capture of 174 Metre Hill, but for the loss of 1,800 men and they gained no further ground thereafter. In total some 16,000 Japanese soldiers were killed or wounded during the fighting, mostly falling to the fire of the Maxims. The Russians had sited their guns to provide fire in enfilade, the bullets travelling lengthwise along the advancing front, coming from either flank and raking the advancing lines of infantry from left to right. By siting guns

LEFT A still from a training film of 1914, showing a very early-manufacture Mk I Vickers, identifiable by the five-bridge rear sight. The crew nearest the camera wear full infantry equipment and rifles and are carrying heavy ammunition boxes. Such weight was excessive so in 1915 Machine Gun Corps crews were issued Webley revolvers to replace rifles and seldom carried full equipment. (Author's collection)

RIGHT An unusual photo of the Machine Gun Company of the 1st Rifle Brigade, at the outbreak of World War I. Both Maxim .303in guns have had their brass water-jackets camouflaged, apparently with green, brown and yellow paint. The gunner crouching far left, Corporal J.W. Brooks, won the Distinguished Conduct Medal with his gun at Le Cateau in 1914 and the Military Medal the following year. (Eugenie Brooks)

in this manner, the Russian defenders created an interlacing cone of fire that was almost impossible to move troops through. General Sir Ian Hamilton, later to command the Gallipoli expedition, was an observer; he subsequently sent a full and frank report back to the British high command that was entirely ignored.

WORLD WAR I

If Germany was well prepared on the outbreak of war in August 1914, the same could not be said of the British Expeditionary Force. In particular, the tactical importance of machine guns was simply not understood. Although by 1915 the establishment of guns had been doubled to four per battalion, training was at best haphazard, with no specialized training schools for machine-gunners. The men were simply seconded to the machine-gun section and trained by the section commander who, if he was fortunate, had been on a week's course at the Small Arms School at Hythe. A section was comprised of 13 men, a sergeant and officer.

During the first clashes with German troops, German Maxim fire accounted for hundreds of British Regular Army soldiers, who were impotent to deal with the enemy guns. The early brass-barrelled Maxims in use were cumbersome and far too conspicuous, and most were covered by camouflage paint, some of which bordered on the theatrical. Nevertheless, it is interesting to remember that the first Victoria Cross of the war was won by a machine-gunner, Private Sidney Godley of the 4th Royal Fusiliers, who used his section Maxim to hold the Nimy railway bridge at Mons, preventing the Germans from crossing it for two hours. Futile British attacks in 1915 at Aubers Ridge and Loos only served to reinforce what men such as Hamilton and other machine-gun champions such as Brigadier-General Christopher Baker-Carr, Major George Lindsay and Lieutenant-Colonel Nicholas McMahon had long been saying – British machine-gun numbers and tactics were inadequate and lagged well behind German understanding and employment. It soon became clear that having infantry-battalion machine-gun sections severely limited the weapon's effectiveness and that, despite the enthusiasm the men had for their guns, training was wholly inadequate.

The inauguration of the Machine Gun Corps in October 1915 at last heralded a step in the right direction towards a professional approach to the use of machine guns on the battlefield. A comprehensive ten-week course was set up at the Machine Gun School at Belton Park, Lincolnshire, teaching every aspect of the mechanical and tactical use of the Mk I Vickers guns that were by then general issue. Men learned to recognize the four major stoppages by the position of the cocking handle, to strip and replace parts blindfolded, and to calculate range, direction, fire angles and all of the other complex computations that were needed for effective use of machine guns on the modern battlefield.

Even so, the Army still had a lot to learn, as the Somme offensive of July–November 1916 showed. The impossibility of advancing against well-sited machine guns was perfectly demonstrated by the futile attacks against German machine-gun redoubts on 4 July, as recounted by Seton-Hutchinson of the 100th Company MGC:

> Looking across the valley ... I could see men of the 1st Queen's passing up the slope to Martinpuich. Suddenly they wavered ... some two hundred men, their commander at their head had been brought to a standstill at this point. A scythe seemed to cut their feet from under them, and the line crumpled and fell, stricken by the machine gun fire. (Seton-Hutchinson 1932: 130)

The learning process through 1915 and on the Somme was glacially slow, but by the later stages of the Somme battles the Machine Gun Corps had begun to operate with far greater efficiency. During a little-known assault on High Wood on 24 August 1916, the 100th Company MGC made history by employing its ten guns in an indirect-fire role, using them in the manner of artillery, shooting by map reference at high angle. It was the first time the tactic had been used by the Corps, and it worked perfectly:

> A magnificent view of the German trench was obtained at a range of about 2,000 yards. The guns were disposed for barrage. Many factors in barrage work which are now common knowledge had not been then learned or considered. Captain Hutchinson ordered that rapid fire should be maintained continuously for twelve hours, to cover attack and consolidation. Prisoners ... reported that the effect of the MG barrage was annihilating and the counterattacks which had attempted to retake the ground lost were broken up. (Seton-Hutchinson 2004: 146)

Some idea of the reliability of the Vickers guns in service can be gleaned from the fact that the ten guns fired just one belt short of one million rounds, burning out 100 barrels in the process and requiring nearly 375 gallons of water, with one gun firing 120,000 rounds with nothing more than water and barrel changes. To provide sufficient ammunition, two men manned a belt-reloading machine non-stop for 12 hours.

Understanding of the broad role that could be played by machine guns in combat continued unabated. Indirect fire (also called barrage or plunging fire) became standard practice to support attacks and caused

A Canadian Machine Gun Corps lorry moves to the front during the battle for Beaucourt, 9 August 1918. By this time many MGC infantry units were vehicle mounted for speed of response; in this instance the truck has been lightly armoured and the guns mounted ready to provide immediate fire. (IWM CO 3095)

havoc at junctions and busy trench sections behind the lines, for the guns dropped fire into a 'beaten zone' whose size depended on the range, creating an almost impassable area within which any living thing was subject to being struck by a bullet. In August 1918, the 4th Australian Machine Gun Battalion prevented 22 German field guns from operating at a distance of 3,000yd by precisely this method, and the German infantry certainly feared it:

> The British machine gun fire was truly terrible. When we left the bunker we had to cross the road and the bullets rained down, most of

Passchendaele, September 1917 (previous pages)

Machine-gun tactics had greatly improved by 1917, and this illustration depicts two men of the Machine Gun Corps providing close-support fire during the third battle of Ypres. By then, the cornerstone of the German defence was provided by carefully sited Maxims, both light guns such as the MG 08/15 in the foreground, and the heavy MG 08 in the pillbox. Only the firepower of the Vickers or Lewis guns was able to give sufficient cover to the attackers, albeit still at great human cost. The lack of portability of the Vickers and its requirement for large amounts of ammunition and water made its practicality increasingly questionable as warfare became more mobile.

> my section were killed or wounded before we could cross the junction, and many called to us for aid as we ran but we could not stay to help them, it would have been suicide. (Bahrens 1926: 52)

The Machine Gun Corps had by this time expanded to cover infantry, cavalry and motor units and the importance of mobility became paramount. From siting the guns at vulnerable fixed positions in trenches, the requirement by October 1917 was that 'Central control, flexibility and rapidity of action are the three great desiderata of machine guns' (War Office 1917: 9). Vickers guns were equipped with small emergency 'Sangster' tripods, strapped to the water-jacket to enable them to be put into action without the tripod, and guns were routinely moved forwards with the infantry to provide close-support fire. It was dangerous work, as the gunners were the subjects of immediate sniping and heavy artillery retaliation, as H.C. Lawrence of the 33rd Machine Gun Battalion recalled:

> [At Vimy Ridge] we were employed in putting harassing fire. We were warned we would only have time for two belts of 250 rounds. We erected canvas baffles which we soaked to hide the flash. On receiving the order to fire we allowed the guns to shake, this covered the whole of the crossroads. We immediately dismantled and rushed to our dugouts. On visiting the spot in the morning we found great craters where our guns had been. (Quoted in Goldsmith 1994: 96–97)

By the end of World War I the Vickers guns of the Machine Gun Corps had been employed in every theatre of war and had earned seven more Victoria Crosses.[6] There was little doubt that its efficient use had been a significant factor in ending the war, particularly during the last 'Hundred Days' of fighting in 1918, where British and Commonwealth machine-gunners put into practice everything they had so far learned, inflicting huge casualties on the retreating German Army. When the armistice was declared at 11am on 11 November, one of the last recorded actions was by a German machine-gun officer, who fired off a final belt, removed the lock of his MG 08, stood beside the gun, gave a low bow to the bemused British soldiers, and took his leave.

Hiram Maxim was never to see the conclusion of the war, or to know what the final body count was as a result of his invention, for he had died on 24 November 1916, rich, content and honoured by his adopted country.

INTO WORLD WAR II

Inevitably, once the war ended the Army was reduced in size as quickly as was practical; the MGC was cut to 12 battalions by 1919, being disbanded totally with no ceremony at all three years later. During its short service

6 Awards, with gazette dates: Private H.G. Columbine, 3 May 1918; Private A.H. Cross, 4 June 1918; Lieutenant J.R.N. Graham, 14 September 1917; Lieutenant A.E. Ker, 4 September 1918; Lieutenant D.S. McGregor, 14 December 1918; Lance-Corporal H. Mugford, 26 November 1917; 2nd Lieutenant W.A. White, 15 November 1918.

Machine Gun Corps infantry soldiers man a defensive position during the first battle of the Lys, April 1918. The lack of portability of the Vickers had been largely overcome by this time, and increased use of mechanical transport enabled crews to be taken quickly to where they were needed. (IWM Q 6592)

life it had expanded to 170,500 officers and men and suffered almost 50 per cent casualties, earning it the soubriquet 'The Suicide Club'.

A small cadre of machine-gun companies remained, but in 1937, as it became painfully clear that another war was approaching, the Army decided to increase the number of machine-gunners by forming machine-gun battalions from The Middlesex Regiment (Duke of Cambridge's Own) (six battalions, plus a further two of its constituent unit, Princess Louise's Kensington Regiment), The Cheshire Regiment (five battalions), The Manchester Regiment (five battalions) and The Royal Northumberland Fusiliers (five battalions). Each battalion comprised four companies of three platoons with four Vickers guns each (48 per battalion) but, additionally, every line-infantry battalion had its own machine-gun platoon, so every division theoretically possessed a total of 96 guns.

Because mobility was now the key to using medium machine guns in the field, each battalion needed a staggering 128 cars, carriers and trucks, plus 49 motorcycles to carry the guns and equipment. A new training school was set up at the Support Weapons Wing at Netheravon in Wiltshire to train Vickers crews, and once more the gunners were to be at the forefront of the fighting. The Vickers served in the jungles of South East Asia, North African deserts and European fields with equal aplomb.

During the advance through northern France after D-Day, machine-gun units were often employed to deal with snipers and anti-tank units.

Although this photograph might well have come straight from 1918, it is Derna, North Africa, in 1941. The very distinctive plume of steam from the condenser can is quite evident. (IWM E 1819)

One Vickers team, detecting a concealed PaK 37 gun, opened such murderously accurate fire that the crew fled enabling the Allied troops to advance safely:

> We could see a small copse which seemed to be empty, but one of our observers assured us there were Jerry guns in it, so we opened up with both [Vickers] guns from about 800 yards, giving them six belts each while the infantry worked their way up the hill. When they got there the Jerries had gone, leaving only their dead behind. Our fire had smashed the gunsights, punctured the shell cases and destroyed the engines of the trucks. We were everyone's favourites after that and we were often called on to give close supporting fire during a local assault, the only thing we couldn't deal with was the tanks. (Bevior n.d.)

While it is sometimes thought that the Vickers was sidelined during World War II this is far from the truth. In fact, using the tactical experience gained during World War I, machine-gun units employed Vickers guns more and more frequently in conjunction with other divisional specialists, so their firepower complemented that of the battalion mortars, light artillery and medium guns, such as the 20mm Bofors. As one historian wrote, 'It was the intention that they should cover every inch of the ground over which a divisional attack was to

A gun team of the 1st Middlesex lay down supporting fire at long range somewhere in North West Europe, winter 1944. The No. 1 is using the dial sight and the parabolic muzzle attachment is clearly visible. The sharp-eyed may notice that this image has been printed in reverse, as the belt is feeding from the left! (IWM B 14757)

pass, bullets, shells or bombs covering the area like pepper coming out of a pot' (Kemp 1956: 94).

When put to use, these tactics proved incredibly effective, the machine-gun teams of the 1st Manchester firing 338,000 rounds on the night of 3/4 August 1944 along with 5,700 4.2in mortar shells and 120,000 20mm cannon rounds in support of the attack by the 4th Royal Welch Fusiliers on Caen and Évrecy. During the course of the drive through Italy in 1943–45, the ammunition expenditure returns for the 6th Cheshire show that their Vickers guns used 6,000,000 rounds. But the writing was on the wall for the old guns, for compared to the new breed of light machine guns such as the German MG 34 and MG 42 – and the compact Bren gun – the Vickers was expensive, time consuming to maintain and required considerable training for its crews to become efficient.

POST-WAR SERVICE

In 1947 the Vickers gun was withdrawn from front-line service with the Regular Army, but retained by Territorial units, and the school at Netheravon was closed; it was quickly re-opened in 1950, however, when the Korean War broke out, in which the guns proved their worth once more. In their defence of Hill 235 on the Imjin River on 22–25 April 1951, the Vickers guns of the 1st Gloucestershire were to cause such carnage among the attacking Chinese forces that they virtually wiped out one division, Chinese losses being estimated at 15,000 killed and wounded.

For the Vickers gun, though, it proved a temporary stay of execution as it had been gradually supplanted by the new lighter general-purpose machine guns, as well as the more effective use of mortars – the 81mm mortar had an effective range of 5,675m (6,206yd), required only three crew who needed far less intensive training, and was also much, much cheaper to manufacture. Despite the employment of the .5in Vickers since 1933 for vehicle and air use, the Vickers had gradually been overtaken in service by the very effective and far more powerful .50in Browning M2 machine gun, which is still in widespread NATO use today. The last recorded use of the gun by a British unit was in Libya in 1963, when the reconnaissance/machine-gun section of the 1st Gloucestershire used up its remaining ammunition in the desert:

> The battalion watched as the elderly weapons shot out their streams of ball ammunition interspersed with the odd round of tracer which burned out long before the bullets struck the desert surface at extreme range. It was a sad occasion, but no-one watching could fail to recognise the power, the range and the lethality of these 'museum pieces'. (Chappell 1989: 24)

The .303in Mk I Vickers was officially withdrawn from service in 1968, but only after one final magnificent demonstration had been made by the armourers at Strenshall Barracks, Yorkshire. They selected one gun at random and then fired it non-stop for seven days and nights, consuming 5,000,000 rounds of Mk VII .303in ammunition, as Sergeant T.R. Ashley recalled:

Despite its weight and complexity, the Vickers saw service in every theatre of operation during World War II. These grizzled jungle veterans are from the 14th New Zealand Machine Gun Company on Vella Lavella Island, South Pacific, in October 1943, and the gun is a very early Mk I. (Wellington War History photo WH-241)

During the Korean War a Vickers crew check over their gun prior to taking it into action. It has a protective water-jacket cover, first introduced in 1918, designed not only to prevent the crew burning themselves but also to help prevent the coolant water freezing in sub-zero conditions. Some crews added vehicle antifreeze, but the best prevention was either to drain the water, or to fire a short burst every half hour. (IWM KOR 515)

> The two man crew was relieved every thirty minutes. The gun fired 250 round belts without stopping. At the end the gun-pit was surrounded by mountains of boxes, belts, cases, debris: a large cleft had appeared in the stop butts where the bullets had destroyed the butts. We took the gun ... back to the workshop. We inspected and gauged it. No measurable difference anywhere. It had eaten barrels, they were changed every one to 1½ hours but mechanically [the gun] was unchanged. (Quoted in Goldsmith 1994: 188)

It was a fitting postscript for the most durable machine gun ever used in British service. What happened to the thousands stored in depots across the country is unknown; most have simply vanished over the years and early examples exist now only in a few museum collections and in the hands of private collectors.

Korea, November 1951 (opposite)

In this plate, soldiers of the Machine Gun Company of the 1st Gloucestershire are providing long-range barrage fire at distances beyond those visible to the naked eye. The gun commander has determined range with the aid of maps, and the guns have been set using their Mk II dial sights. Large amounts of ammunition and water have been stockpiled as each gun could fire 100,000 rounds during such an operation. This illustrates the use of the guns in an artillery role rather than for front-line defence. By the 1950s these medium machine guns were already being supplanted by the mortar, and their service future was under debate.

IMPACT
Transforming the battlefield

It is clear now that the introduction of the Maxim gun transformed the way in which 20th-century wars were fought, in much the same manner that the rifled musket changed the face of linear warfare in the 19th century. But at the time of its conception few senior soldiers recognized that the new weapon was anything more than an adjunct to the artillery, and its tactical use was initially limited to much the same as that of its heavy, carriage-mounted cousin. It took considerable battlefield experience before the armies equipped with these new weapons could begin to appreciate their abilities, and it was perhaps fortunate for the British Army that much of this experimentation took place against relatively poorly armed native forces. How the British would have fared early on in a major conflict against a similarly armed enemy such as the Boers is interesting to speculate upon.

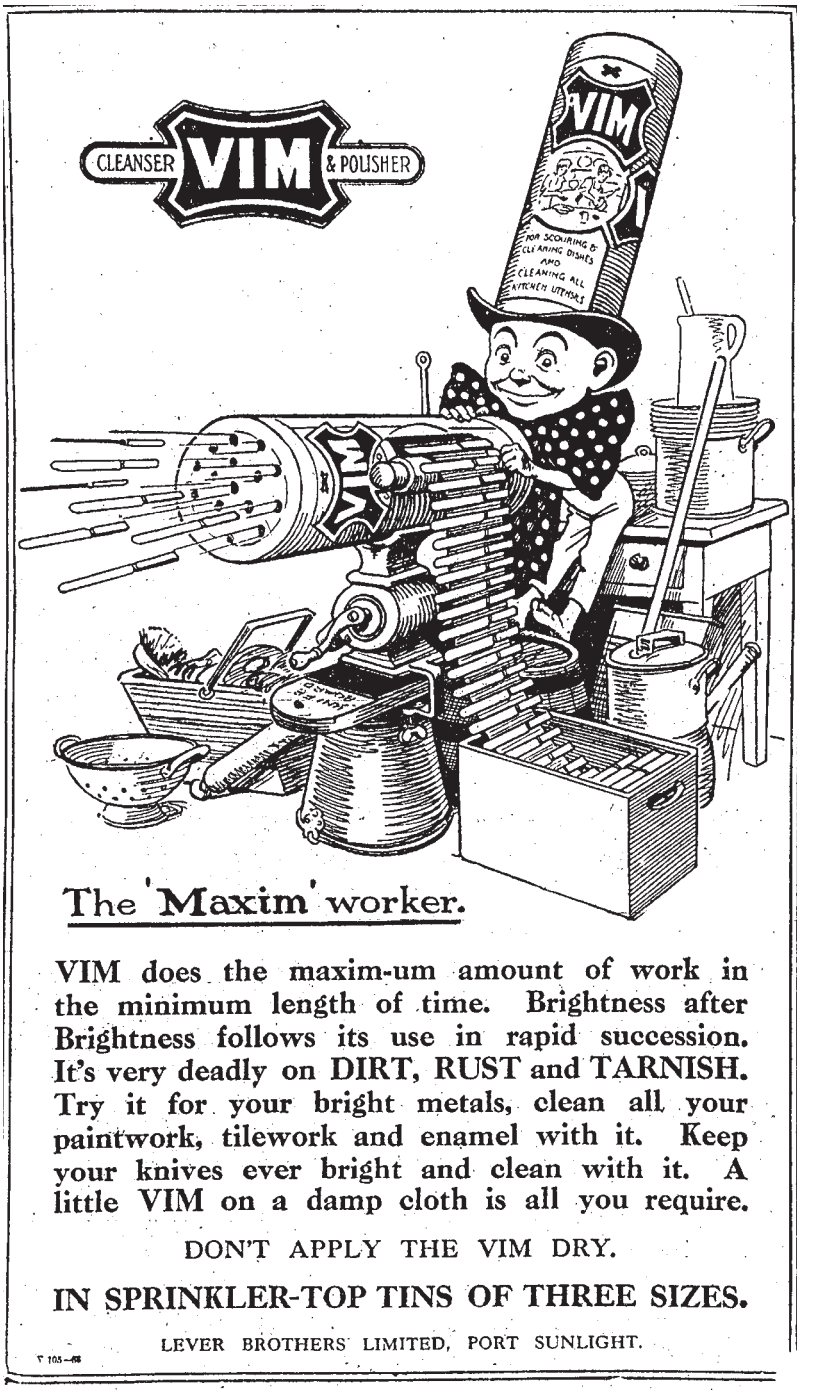
Even so, when war broke out in 1914, Britain was outgunned, in every sense of the term, by the Germans' use and tactical understanding of their Maxims; it was certainly ironic that during the greatest war the world had yet known the two major powers faced each other using these two virtually identical weapons. Unquestionably, the use of the Vickers and Maxim guns through World War I shaped how the battles were fought. It was soon clear to the most wooden-headed commanders that the massed frontal assaults that were commonplace during 1915 and 1916, against well-sited machine guns, were tactical suicide and infantry tactics had to become far more flexible. For their part, by 1917 the machine-gun units of the British Army had adopted a more planned, cohesive approach, where machine guns were used in close conjunction with the infantry, providing both long-range and localized fire support.

The heavy water-cooled weapons were also too clumsy and vulnerable when in the front line; a single bullet or shrapnel ball

Passchendaele, 1917. Private Reginald Le Brun of the 16th Canadian Machine Gun Company shares a series of waterlogged shell holes with his gun crew. Their job was to provide support fire, but soon after this photograph was taken, they were targeted by German artillery. The entire crew with the exception of Le Brun were killed. (IWM CO 2246)

puncturing the water-jacket rendered a gun inoperable and required its removal from the line for repairs. The sheer cost of warfare on such a colossal scale was also becoming a consideration, as governments looked ever more closely at cheaper forms of mass production. The high-quality firearms of the Victorian era, with their hand finishing and beautiful finish, were simply not cost-effective in an era of industrialized total warfare. Cost had become the new God of War and in manufacturing terms, a Vickers gun made in 1916 was equivalent to six Lewis guns or 15 Lee-Enfields; in terms of speed, the much simpler Lewis could be made in a quarter of the time it took to make a Vickers. Field maintenance was also demanding: Vickers guns needed huge supplies of belted ammunition, barrels and copious quantities of water – as well as a seven- or eight-man crew and the transport to move it all. A Lewis gun, despite its relatively complex mechanism, could be served by two men, required a spares kit that could be carried in a haversack and being air-cooled could continue functioning even with a badly damaged jacket, using any loose .303in ammunition to hand.

The Maxim gun caught the public imagination and this advertisement, dating from about 1900, has used the evident firepower of the machine gun to emulate the cleaning action of the powdered bleach. The fact that the gun actually resembles a Gatling was probably lost on the artist. (Author's collection)



These reasons are certainly why the German Army chose to cease using the Maxim as its front-line machine gun in 1934, when it brought the MG 34 into service, although examples of the MG 08 and MG 08/15 continued to appear on most battle fronts through World War II. Britain had adopted the Bren gun in 1938 as a light support weapon, but chose not to replace the Vickers with a simpler gun; this was in part because of

cost (there were after all thousands of serviceable guns in store), but also because changes in tactical doctrine had given the Vickers a new lease of life, for its use as a barrage/attack support weapon enabled it to be more frequently employed behind the lines, where its vulnerability to enemy fire was much reduced.

Training the soldiers was also an important consideration, for a ten-week course to bring a man up to full efficiency as a Vickers gunner was a long time for him to be out of the line. In World War II, mortar crews could be trained in under a week and the mortars performed well at far greater ranges than the Vickers, combining excellent accuracy with greater lethality than a medium machine gun, with the added advantage that they were easily portable and almost impossible to detect. In fact, it was the widespread adoption of mortars that would help seal the fate of guns such as the Vickers – as well as the introduction of the heavy machine gun, in the shape of .50in and 12.7mm guns that had considerably greater range, target penetration and the ability to use a much wider range of projectile types.

In 1918, a General Staff report had stated: 'Next to the artillery, the machine gun is the most effective weapon employed in modern war, and against troops in the open at suitable ranges it is proportionately even more effective than artillery. The distinguishing feature of modern machine gunnery is its offensive power. Modern machine gunnery has reversed the passive tendency' (Seton-Hutchinson 2004: 204). While that was certainly true in 1918, the traditional delineations between infantry rifle, machine gun and artillery had become blurred by the end of World War II as weapons deployment changed and wars became smaller in scale and faster moving.

CONCLUSION

The entire concept of the Vickers-Maxim guns was fitted to a time and place where they were, without doubt, the technological masters of the battlefield. They were designed to achieve exactly what they did and were extremely efficient at doing it. That the Vickers Company's experiments in improving the gun were worthwhile is unquestionable, for it was lighter and more portable than the Maxim, with a simpler mechanical system and faster rate of fire. Even so, as the inexorable march of technology continued, it became apparent that there was little that could be done to simplify the Vickers, for the basic design did not lend itself to any further major modifications.

A late-model Vickers in Kenya, 1954, with two very young National Servicemen providing barrage fire, although judging by the low angle of the gun one wonders if this was purely for the benefit of the cameraman. Note that a Vickers gun ejects its cartridges vertically, while the Maxim and MG 08 throw theirs forward of the mount legs. (Simon Dunstan)

The terrible casualties caused by machine guns during the colonial wars and early in World War I were never to be repeated as defence in depth became the new strategy. From early 1917 the German Army used systems of concrete bunkers with overlapping fields of fire and thinly manned trenches to hold back British attacks, and for their part, the British made greater use of light machine guns when attacking, Lewis guns being predominant. Indeed, by the end of the war they were in use at the ratio of 3:1 compared to the Vickers and, to those who observed such things, it was already apparent that the days of the medium water-cooled machine gun were numbered.

The Vickers-Maxim was sophisticated and expensive and in the late 19th and early 20th centuries this was acceptable, but by the end of World War I the price was already becoming too high. That the gun survived in front-line service for as long as it did says much about its build quality and the original concept thought up by a quiet American from Maine.

Men of the 2nd SAS in Castino, Italy, with a tripod, Vickers and as much ammunition as they can carry. The tripod is being carried in the most comfortable manner, with the front legs resting on the shoulders. Their varied equipment and slightly unsoldierly appearance mark them out as specialist troops – they could easily be mistaken for partisans. (IWM NA 25407)

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Dedication

To the memory of J.W. Brooks DCM, MM, one of the first of the 'Suicide Club'.

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Editor's Note

For ease of comparison please refer to the following conversion table:
1 mile = 1.6km
1yd = 0.9m
1ft = 0.3m
1in = 2.54cm/25.4mm
1 gallon (Imperial) = 4.5 litres
1lb = 0.45kg